VAMC WEST HAVEN CAMPUS
950 Campbell Avenue
West Haven, Connecticut 06516

Building No. 1
Pathology HVAC Upgrades
Project No. 689-08-102

100% Bid Documents

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West Haven, VA Medical Center
Contractor Safety Manual

1.0 GENERAL INFORMATION

1.1 Standard Safety and Security Rules

The following are some reasons for which an employee of a contractor may be temporarily or permanently removed from West Haven Veterans Administration Medical Center (West Haven VAMC) premises:

- Possession or use of alcoholic beverages or regulated drugs not prescribed by a physician.
- Possession of explosives, firearms, ammunition, and other weapons.
- Deliberate violation of safety or security rules.
- Illegal dumping, handling, or disposal of hazardous materials.
- Destruction or removal, without written permission, of any property belonging to West Haven VAMC, the property owner, employee, or other contractors or employees.
- Intimidating, threatening, harassing, impeding or interfering with an inspector, security officer, or West Haven VAMC employee or designated representative.
- Using emergency exits other than for emergencies.
- Misuse of fire prevention and protection equipment.
- Unauthorized removal or destruction of a safety barricade, handrail, guardrail, warning sign, fall protection, or other warning devices intended to protect West Haven VAMC's patients, employees, neighbors or property.

1.2 Safety Permits and Procedures

The following operations may present a hazard to West Haven VAMC's patients, employees, neighbors or property. Therefore, you must obtain approval through the West Haven VAMC Contracting Officer Technical Representative (COTR) before:

- Working on fire protection/detection systems.
- Performing burning, welding, cutting, soldering, or other hot work.
- Working on electrical, steam, chilled water systems or other energized systems.
- Moving emergency equipment (fire extinguishers, first aid kits, etc.) provided by West Haven VAMC.
- Installing a temporary electrical service.
- Working with hazardous chemicals (including solvents and paints).
- Generating hazardous wastes (including waste oil).
- Using powder actuated tools.
- Using a gas, diesel, or LP (propane) powered engine indoors.
- Operating a power vehicle or self-propelled work platform.
- Excavation/trenching.
- Using radioactive sources or conducting field radiography (x-ray).
- Working with asbestos-containing materials.
- Working on security systems.
- Working with compressed air/gases.
- Using a laser.
- Working on a fume or biological hood.
- Working on a solvent storage cabinet.
- Working on heating, ventilation, or air conditioning equipment.
- Working on a roof.
- Lifting or hoisting with cranes, derricks, hoists or helicopter.
- Performing blasting operations.

Special Rules for Operations Involving Utilities:

- Only West Haven VAMC Facilities Operations may shut down or start up operating utilities.
- You must notify your COTR, who will coordinate with West Haven VAMC Facilities Operations, *a minimum of one week in advance - in writing* of the need for such shutdowns or startups.

Special Rules for Lockout/Tagout of Machinery, Pipes, etc.:

- If you intend to service or maintain machinery that could hurt someone if it were to unexpectedly start up, you must inform the West Haven VAMC COTR of the lockout/tag-out procedures you intend to follow.
- See Section 3.3 on Lockout/Tagout generally.

1.3 Housekeeping

You must maintain good housekeeping. You must keep work areas neat, clean, orderly and free of excess trash and debris and never block walkways, stairs, exits, or create a tripping hazard. Cover and/or place guardrails around open holes, trenches, or excavations into which VA's patients or employees may fall. Poor housekeeping at a job site may lead to an increased potential for safety hazards and an increased incidence of accidents and chemical spills.

1.4 Accident, Incident, Injury, or Illness

After notifying the appropriate emergency agency (e.g., 9-1-1), work related accidents, incidents, injuries, and illnesses must be immediately reported to the West Haven VAMC COTR or representative. The Contractor is responsible for notifying OSHA for any incidents that are reportable to that agency.

2.0 ENVIRONMENTAL ISSUES

2.1 Hazardous Waste Management

Hazardous waste generated by a Contractor as part of its work must be properly identified, stored and disposed of in accordance with all applicable local, state and federal laws. The Contractor must coordinate with its West Haven VAMC representative to provide a list of hazardous waste(s) to be generated during the
project, and to determine the location(s) available for hazardous waste storage. The Contractor must also ensure, at a minimum, proper labeling, adequate secondary containment, segregation of incompatible materials and routine inspection of storage areas as required by law. In addition, all hazardous waste containers shall be constructed of a material that is compatible with the waste, shall be in sound condition, and shall be kept securely closed at all times in accordance with RIDEP regulations. Containers and/or tanks used to store hazardous wastes must be managed in accordance with RIDEP regulations and must be inspected daily.

The Contractor is responsible for completing all disposal documents, which may include, but are not limited to, waste profiles, waste analytical samples and hazardous waste manifests. West Haven VAMC (Safety Office, 950 Campbell Avenue, West Haven, CT 06516) shall be designated as the Generator on all documents and shall be provided with copies of all waste analyses, land disposal restriction forms and related documentation. Copies of all disposal documents shall be submitted to the COTR for review at least 5 days prior to shipment. The COTR or a Safety Office representative will sign the manifests as the Generator. At the time of shipment, the Contractor shall provide the bottom three copies of the manifest to the COTR or the Safety Office representative for distribution to the appropriate agencies.

The following table provides the specific generator status and EPA Identification Numbers that should be used on all hazardous waste manifests:

Generator Status
Site Address Hazardous
Waste
Waste Oil
EPA ID or DEP
Registration

Contractor employees must be appropriately trained in hazardous waste procedures. In the event a Contractor encounters previously unidentified material that is reasonably believed to be radioactive, volatile, corrosive, flammable, explosive, biomedical, infectious, toxic, hazardous, asbestos containing or oil-based, the Contractor shall immediately stop work in the affected area and report the condition to the COTR. At no time shall such material be disposed of in chutes, dumpsters, drains, pipes or any other waste container. The Contractor agrees to cooperate with the COTR and any consultants engaged by the COTR to perform services with respect to the analysis, detection, removal, containment, treatment and disposal of such regulated materials.

2.2 Transport of Hazardous Materials

All transportation of hazardous materials while on West Haven VAMC property shall be conducted in accordance with USDOT Hazardous Materials Regulations for proper packaging, marking/labeling, handling, documentation, etc. At no time should hazardous materials be transported via public or private roads at West Haven VAMC in a manner that could result in an unsafe condition for personnel or the environment.

2.3 Spill Prevention and Control

West Haven VAMC's Spill Prevention Control and Countermeasures (SPCC) Program establishes Medical Center-wide procedures for the prevention and detection of spills and/or releases of oil or hazardous materials, including the following:

- Based on the inventory of oil and hazardous chemicals that will be brought on-site, the Contractor shall have available equipment (e.g., secondary containment pallets, absorbent pads, absorbent booms, speedi-dry, etc.) that is suitable and sufficient to control a potential spill/release.
- The Contractor is responsible for identifying conveyances to the environment (e.g., sumps, storm/floor drains, etc.) and adequately minimizing spill potential to these areas.
- The Contractor is responsible for the proper storage of all flammable and combustible chemicals that are brought and/or stored on site to complete the work of this contract. Such storage may require the use of safety containers, safety cabinets, and/or secondary containment. The Contractor shall also ensure that any incompatible chemicals are safely segregated. The Contractor is responsible for maintaining and securing all chemical containers and all chemical storage areas. This requires selecting locations and methods to minimize exposure to rainfall, surface water, and the ground surface or subsurface. Enclosures, shelters, and secondary containment should be used where appropriate.
- The Contractor must use appropriate protective procedures such as double containment, employee training, overflow protection, and other measures as part of activities involving the use, storage, or handling of petroleum products or hazardous materials on West Haven VAMC property.
- The Contractor must ensure that his/her employees are adequately trained in spill procedures outlined below.

The Medical Center's SPCC Program also establishes reporting requirements in the event of a spill or release of oil or hazardous materials. In the event of a release or spill, the Contractor must follow all of the reporting requirements of the SPCC Program as specified below:

(1) The Contractor shall extinguish all sources of ignition and isolate incompatibles or reactive chemical substances.

(2) The Contractor shall determine if the spill/release is incidental or non-incidental.

(3) For incidental spills/releases:

♦ The Contractor shall attempt to stop or contain the spill/release at the source provided that doing so does not endanger anyone.

♦ The Contractor shall prevent discharge of materials to environmental receptors including drains, sumps, soil, etc.

♦ The Contractor shall immediately notify the COTR of all incidental spills/releases.

♦ The Contractor is responsible for the proper collection, storage and disposal of waste materials in compliance with EPA and DEP regulations and in cooperation with the COTR.

(4) For non-incidental spills/release:

♦ The Contractor shall immediately report the spill/release to the Medical Center Safety Office. The Medical Center's Safety Office will advise you on the need for initiating contact with spill response vendors.

♦ The Contractor shall follow the steps for incidental spill/releases identified in item (3) above, provided that it is safe to do so.

♦ VA's Safety Office will coordinate ALL reporting to outside agencies and will conduct follow-up written notifications if necessary.

♦ The Contractor will conduct an incident analysis and coordinate with the COTR and Medical Center Safety Office on any actions that are required to prevent recurrence.

♦ If it is deemed necessary to engage a professional spill cleanup company, Medical Center Safety Office will coordinate the cleanup through the COTR.

2.4 Pest Control

If a Contractor or his/her employees see evidence of cockroaches, mice, ants or other pests during the course of their work, they must notify the COTR immediately. The Contractor shall not use any insecticide products on Medical Center property unless such activities are part of your contracted work and you are specifically trained to do so.

2.5 Air Emissions

Combustion Units

[Combustion units include, but are not limited to, boilers, heaters, emergency generators.]

[1] ***"Incidental"*** spills meet **ALL** of the following criteria: 1) personnel are familiar with the hazards associated with the spilled material; 2) containment/response does not pose potential health and safety hazards (e.g. fire, explosion or chemical exposure); 3) a small quantity (less than 10 gallons) of material is spilled/release which **DOES NOT** reach the environment or pose potential health and hazardous; and 4) spilled/release material can be readily absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate area or by maintenance personnel.

[2] ***"Non-incidental"*** spills include 1) major spills/release (e.g. greater than 10 gallons) that do not reach the environment
or 2) any amount of spilled material that escapes to the environment (including drains, sumps, soil, etc.).

All Contractors must immediately report the following to the COTR:

- Any maintenance or repairs to a combustion unit that could result in a change in maximum heat input value or overall emissions (e.g. burner replacement or fuel conversions).
- Any conditions discovered which could have resulted in an increase on air pollutant emissions.

CFC Containing Units

[CFC containing units include those containing any ozone depleting refrigerants including, but not limited to, Chlorofluorocarbons (CFC) and Hydrochlorofluorocarbons (HCFC).]

Contractors shall immediately notify the COTR whenever they become aware of any unintentional or intentional release of CFCs above de-minimis levels as established by EPA regulators. Contractors shall provide the following documentation to the COTR:

- EPA certifications for any reclaimers to which CFC products evacuated from West Haven VAMC systems are to be sent
- Certifications for any CFC recycle/recovery equipment to be used at VAMC.
- Technician Certifications.
- Service records for all units containing greater that 50 pounds of refrigerant. Records must include the date and type of service and the type and quantity of refrigerant added.

Contractors shall immediately notify and provide documentation to the COTR whenever:

- A leak rate equals or exceeds 35% per year for commercial/industrial processes
- A leak rate equals or exceeds 15% per year for comfort cooling processes
- A release occurs of >100 pounds in a 24 hour period for CFC-12, CFC-113 ad R-500.

Halon

Service providers shall immediately notify the COTR whenever it becomes aware of any unintentional or intentional release of halon.

2.6 Stormwater and Wastewater

Stormwater

Projects that disrupt over one (1) acre of land must adhere to the EPA's Phase II stormwater requirements. These projects are required to obtain a NPDES permit and implement best management practices. The Contractor is responsible for obtaining such permits before the start of work.

Wastewater

West Haven VAMC's wastewater discharge is regulated by the Rhode Island Water Resource Authority (RIWRA). The discharge of any wastewater must adhere to RIWRA Specific Prohibitions.
These include but are not limited to:

- No discharge of mercury, silver or other metal-bearing wastewater.
- No discharge of highly corrosive substances ($5 < pH > 10.5$).
- No discharge of flammable materials that could create a hazard for West Haven VAMC personnel or WRA treatment works personnel.

The Contractor must identify all wastewater streams for the COTR and obtain approval for drain discharge. In addition, for excavation projects, the Contractor is responsible for obtaining and adhering to the RIWRA Dewatering permit.

2.7 Biological/Chemical/Radioactivity Hazards

Some West Haven VAMC operations involve the use of biological, chemical, or radioactive material that can be hazardous to VAMC patients or employees if not handled safely. Areas where work with biological, chemical, or radioactive materials is being performed will be marked with appropriate signs. Do not enter these areas and do not handle hazardous biological, chemical, or radioactive material unless it is part of your contracted work and you are specifically trained to do so.

2.8 Asbestos Containing Materials

West Haven VAMC will have determined, before work is begun, the presence, location, and quantity of asbestos-containing or potentially asbestos-containing materials that would be specifically impacted by the work of your contract. The West Haven VAMC COTR will provide a specific asbestos audit report for those work areas in question. The Contractor shall not disturb asbestos-containing materials unless such activities are part of your contracted work and you are specifically trained to do so. Asbestos abatement contractors should coordinate with the COTR and the Medical Center's Safety Office for specific requirements for asbestos abatement work.
The Contractor shall not disturb, damage or otherwise handle any *suspect* asbestos containing material. It is recommended that the following suspect materials be assumed to contain asbestos:
Cement Pipes/High Temperature Gaskets/Electrical Wiring Insulation
Cement Wallboard/Lab Hoods/Benches/Gloves/Chalkboards
Cement Wallboard/Fire Blankets/Curtains/Doors/Roofing Shingles and Felt
Flooring Backing/Elevator Equipment Panels/Base Flashing
Construction Mastics/Elevator Brake Shoes/Thermal Paper Products
Acoustical Plaster/HVAC Duct Insulation/Caulking/Putties
Decorative Plaster/Boiler Insulation/Adhesives
Textured Paints/Coatings/Breeching Insulation/Wallboard
Ceiling Tiles and Lay-in Panels/Pipe Insulation/Joint Compound
Spray-applied Insulation/Cooling Towers/Vinyl Wall Coverings
Blown-in Insulation/Electrical Cloth/Asphalt Floor Tile
Fireproofing Materials/Heating and Electrical Ducts/Vinyl Sheet Flooring
Taping Compounds/Electrical Panel Partitions/Vinyl Floor Tile
Packing Materials (wall/floor penetrations)
Ductwork Flexible Fabric/Connectors/Spackling Compounds
The Contractor shall not sweep, dust, vacuum or mop dust or debris that is the product of a suspect asbestos containing material. The Contractor shall also not pick up or throw away any suspect asbestos-containing

waste or trash. If it material that is suspected to be asbestos-containing is disturbed and becomes airborne, the Contractor shall immediately notify the COTR and the Safety Office. If it is part of the Contractor's work, stripping of floor finishes shall be done using low abrasion pads at speeds lower than 300 rpm and wet methods shall be used. The Contractor shall take care not to overstrip floors and shall stop stripping immediately upon removal of the old surface coat. Sanding of flooring material is strictly prohibited unless it is part of your contracted work and you are specifically trained to do so.
Any suspect asbestos containing material that is observed by the Contractor to be crushed, ripped, broken or in any way damaged should be reported to the COTR immediately. Contractors must, within 24 hours, convey to the West Haven VAMC COTR any information they newly discover concerning the presence, location and quantity of asbestos-containing or potentially asbestos-containing materials.

2.9 Lead Paint

Contractor's should assume that any painted surface they come in contact with is coated with lead-based paint.
Therefore, Contractor's should not perform any intrusive, dust-generating work on painted surfaces (e.g., drilling, cutting, brazing, scraping, demolition), unless the surface has confirmed to be non-lead or unless such work is part of your contracted work and you are specifically trained to do so.
Any painted surfaces that have loose, flaking, chipping or otherwise non-intact paint should not be impacted by the Contractor and should be reported to the COTR immediately. Lead paint abatement contractors should coordinate with the COTR and the Medical Center's Safety Office for specific requirements for lead abatement work. Refer to the section of this manual on Hazardous Waste for guidelines on the proper disposal of lead containing paint.

3.0 OSHA SAFETY ISSUES

3.1 Hazardous Materials and Hazard Communication

Hazardous Materials

- Do not handle or use hazardous materials without training by your company's representative.
- No solvents, paints, or similar flammable, toxic, or irritating materials may be used in areas occupied by West Haven VAMC patients or employees, unless specifically approved in writing by the West Haven VAMC COTR.
- Maintain adequate ventilation when paints or solvents are used.
- Use flammable solvents and materials with extreme caution.
- Store flammable paints and solvents in approved flammable liquid storage cabinets if inside buildings.

Hazard Communication

The Contractor shall submit an inventory of all hazardous chemicals that are brought on-site with accompanying Material Safety Data Sheets to the COTR. The Contractor shall also ensure that all containers that are brought on site for the storage of hazardous chemicals (e.g., gas, paint, etc.) are labeled and inspected in accordance with all applicable regulations. The Contractor shall remove all hazardous chemicals that it brings on-site when work involving a specific hazardous chemical is complete. The Contractor may request and review Material Safety Data Sheets for any chemicals that are encountered on Medical Center property during the performance of its work.

3.2 Confined Space Entry

Background

West Haven VAMC has developed and implemented a Confined Space Entry Program to protect all Medical Center employees who are required to enter confined spaces. The VAMC's complete written program is available for review upon request to the Safety Officer.

This Medical Center-wide program defines a "Confined Space" and an "Enclosed Space" in accordance with 29 CFR §§ 1910.146 and 1910.269, respectively. Entrance into any of these spaces by a Contractor requires adherence with all applicable regulations as well as with certain Medical Center protocols as defined further below.
As part of the Confined Space Entry Program, the Medical Center performed hazard assessments, developed inventories and posted all confined and enclosed spaces at the point of entry. These postings

include information on the classification of the space (e.g., “Permit Required”, “Non-permit Required”), the confined space ID number, the location, the known hazards, and the minimum personal protective equipment needed for entry. Where available the Medical Center’s experience with the confined space is also included on the signage. The Medical Center Confined Space Inventory and hazard assessment forms are available at the Safety Office.

Requirements

- The Contractor is responsible for developing, implementing and maintaining his/her own Confined Space Entry Program, including provisions for emergency rescue in accordance with OSHA regulations as it applies to the work of this contract.
- If during the course of its work, the Contractor encounters a confined space that has not been previously identified by the Medical Center, it must immediately bring the space to the attention of the COTR and delay entry until West Haven VAMC Safety Office has examined the space.
- When both Medical Center personnel and Contractor personnel are working in or near confined spaces, the Contractor shall coordinate all operation with the affected Medical Center personnel before entry.
- Advance notification is always required. Whether you enter a confined space with a VAMC employee or not, the Contractor’s entry attendant must always first *inform* the West Haven VAMC Safety Office and COTR *before* you enter a confined space.

The Contractor shall provide the Safety Office with:

- The exact location of the confined space and confined space ID number;
- The time of entry and approximate entry duration; and
- The names of authorized attendants and entrants.
- *After the entry*: If you have entered a “permit-required” confined space, you must, after the entry is concluded, notify West Haven VAMC of (1) the permit space program you followed and (2) any hazards you confronted or created in the space.

3.3 Lockout / Tagout

West Haven VAMC protects its patients, employees, neighbors and property in part by complying with 29 CFR 1910.147 – Control of Hazardous Energy Sources (Lockout/Tagout). As part of the VAMC’s Lockout/Tagout Program standard locks and tags are used to control the start-up of equipment that is being serviced or maintained by its employees. At no time shall the Contractor or its employees override any locks or tags that they encounter during the performance of its work.

The Contractor is responsible for developing, implementing and maintaining his/her own Lockout/Tagout Program in accordance with OSHA regulations as it applies to the work of this contract. The Contractor shall submit a copy of its Lockout/Tagout Program to the Safety Officer before the start of any work where 29 CFR 1910.147 is applicable. The only purpose of this submission is to ensure that, for the safety of VAMC’s, patients, employees, neighbors or property, the Contractor’s lockout/tagout procedures are consistent with restrictions and prohibitions of VAMC’s lockout/tagout program.

- West Haven VAMC Engineering and Utilities will shut down and start up utility systems.
- The Contractor will maintain a log of all machines and equipment that are locked out and/or tagged out during the performance of the work of this contract. This log shall identify the equipment that was worked on, the date that work was performed, and the name of the individual performing the work. The Contractor will submit this log to the COTR on a daily basis when lockout/tagout work is being performed.

3.4 General Electrical Safety

- Only qualified electricians are permitted to work on electrical systems and equipment that uses or controls electrical power.
- Do not operate electrical tools or equipment in wet areas or areas where potentially flammable dusts, vapors, or liquids are present, unless specifically approved for the location.
- Should a circuit breaker or other protective device "trip," ensure that a qualified electrician checks the circuit and equipment and corrects problems before resetting the breaker.
- Erect barriers and post warning signs to ensure non-authorized personnel stay clear of the work area.
- Report hazards (lack of protective guards or covers, damaged equipment, etc.) to the VAMC

COTR immediately.

• Do not leave electrical boxes, switchgear, cabinets, or electrical rooms open when not directly attended. Insulate energized parts when covers have been removed or doors are ajar. Use of cardboard, plywood, or other flammable materials to cover energized circuits is prohibited.

3.5 Compressed Gas Cylinders

Compressed gases can pose a sever hazard to VAMC's, patients, employees, neighbors and property. Therefore, the following measures must be taken for their protection:

• Valve protection caps must be in place when compressed gas cylinders are transported, moved, or stored.

• Close cylinder valves and replace valve covers when work is complete and when cylinders are empty or moved.

• Secure compressed gas cylinders in an upright position in a welding cart or to a solid object (using chains, straps, or a rigid retaining bar). Secure compressed gas cylinders on an approved carrier while being transported.

• Keep cylinders at a safe distance or shielded from welding or cutting operations. Do not place cylinders where they can contact an electrical circuit.

• Keep oxygen and flammable gas regulators in proper working order and a wrench in position on the acetylene valve when in use. If not manifolded together, separate oxygen and flammable gas cylinders by 20 feet or a 5 foot high fireproof barrier.

• If a leak develops in a cylinder and it cannot be immediately corrected, move the cylinder to a safe location outside the building.

• Use only approved spark igniters to light torches.

• Cylinders must not be taken into or stored in confined spaces, including gang boxes and office/storage trailers.

• Do not store hoses and regulators in unventilated or closed containers or areas.

• Do not leave behind partially filled or empty cylinders. Always remove them from the site.

3.6 Powder-Actuated Tools

Powder-actuated tools can pose hazards to VAMC's patients, employees, neighbors and property. Such tools are, therefore, not permitted in occupied West Haven VAMC buildings without the approval of the Medical Center COTR. In addition:

• Contractor's who operate powder-actuated tools must be properly trained in their use and carry a valid operator's card provided by the equipment manufacturer.

• Each powder-actuated tool must be stored in its own locked container when not being used.

• A sign at least 7 inches by 10 inches with bold face type reading "POWDER-ACTUATED TOOL IN USE" must be conspicuously posted when the tool is being used.

• Powder-actuated tools must be left unloaded until they are actually ready to be used.

• Powder-actuated tools must be inspected for obstructions or defects each day before use.

• All Powder-actuated tool operators must have and use appropriate personal protective equipment such as hard hats, safety goggles, safety shoes and ear protectors.

3.7 Welding, Cutting, and Brazing

• Obtain a permit from the project engineer for each separate work activity and ensure that all conditions of the permit are met at all times. The permit must be submitted to the COTR and Safety Officer prior to the start of any welding/cutting/brazing work. In addition, the Contractor must also maintain its own hot work permit system in accordance with OSHA regulations.

• Remove combustible materials from the area before beginning work.

• Elevate oxygen/acetylene hoses seven feet above the work area or otherwise protect them from damage.

• Install anti-flash back (safety/check) valves in both the oxygen/acetylene hoses at the regulator.

• Shield adjacent areas with welding partitions.

• Have a second person stand by with an approved fire extinguisher for welding and burning operations in accordance with OSHA regulations and permit requirements. This person should remain in the area

for a minimum of 30 minutes after the hot work is completed to ensure the site is cold.

3.8 Cranes and Rigging

Each crane, rigging, or hoist brought onto West Haven VAMC property must have an annual inspection performed by a certified testing agency. Additional inspections will be done every day that equipment is on site. Before operations begin on site, documentation, including a log book, must be provided to West Haven VAMC COTR or its designee.

The operator is responsible for the proper placement of the crane in relationship to the load to be handled and the landing area so as to obtain the best rated lift capacity, and the installation and maintenance of crane swing radius protection.

All operators must possess a valid Connecticut hoisting license. Documentation of this license shall be provided to the West Haven VAMC COTR . At no time shall loads be hoisted by a non-licensed operator.

3.9 Miscellaneous Additional Safety Rules for the Protection of West Haven VA Medical Center Patients, Employees, Neighbors and Property.

- Do not perform work over the heads of people or leave tools or equipment overhead.
- Isolate your work area with safety markers, tape barriers, blinker lights, etc.
- Report unsafe acts or conditions to your supervisor.

INFECTION CONTROL MANUAL FOR VAMC

1.1 PURPOSE

To minimize the risk of infection during construction by maintaining the integrity of the environment.

1.2 APPLICATION

Will be determined by Chief of Facilities Management Service and Nurse Epidemiologist.

1.3 EQUIPMENT REQUIRED

Sheet fire retardant polyethylene, or other impervious barrier material, “air moving and filtration devices”, duct tape, clips, framing, and other materials or devices as needed. Sanders, power saws, etc. will have and will use built in dust collections systems as outlined in the construction specifications.

1.4 COMMUNICATIONS

A. The manager of the department where the work will take place, Facilities Management. Services, Police and Security Service, Office of Safety and Infection Control Department will be notified of and /or involved in (as appropriate) the project prior to the start of work, including pre-construction meetings.

B. Problems relating to infection control that arise, at any time, will be reported to the COTR, Infection Control staff, or to the department manager, as soon as possible.

1.5 PROCEDURE

The area in which the construction will occur shall be isolated from the adjacent areas in the following manner unless an exception is authorized by the service chief of the area under construction.

A. Divert airflow construction area to exhaust or atmosphere; add filtering to remove dust before it enters the exhaust air system. Block off supply grills closed and covered) to reduce contamination.
B. Install impervious barriers at construction entrance, from floor slab above and wall to wall using framing, clips, and duct tape, as required, to maintain and secure the barrier seal. 1-hour fire rated barrier shall be maintained at all times.
C. When work is in an extremely sensitive area, double impervious barriers may be used.
D. When ceiling envelopes, chases, and/or spaces are penetrated; barriers will be installed to contain movement of air and debris.
E. Windows must be closed and air ducts shut down or capped, when appropriate.
F. 1-hour fire rated Anterooms (consisting of confined space beyond the barrier) will be provided at entrances to work areas to contain debris and provide workers an area to remove protective clothing and vacuum

off clothing except when workers exit directly to the outside of the building. Compressed air will not be used to remove dust from clothing.

G. Walk-off mats will be at the entrance to work areas during construction.
H. Traffic will be minimized to and from the construction site. Alternative travel routes will be planned, as necessary.
I. If elevators or stairways are within the field of construction, they must have proper barriers installed.
J. Water damaged areas should be demolitioned first. This will be done under HEPA filter exhaust and containment. Waste will be bagged. This will reduce aerosol of microbial agent/fungi/spore escaping during the demolition and transport of this material out of constructions site.
K. The “air moving and filtration device” will be placed into the construction/containment area and will operate to remove dust particles from air and exhaust to the outside.
L. Negative pressure must be maintained in the construction site and to adjacent corridors, and a daily record maintained during construction.
M. Before any construction begins, workers will receive a mandatory infection control handout for training and instructions.
N. Daily inspections will be conducted and documented during construction activities, by construction management, for contractor compliance with infection control requirements.
O. Disruption, violation of barrier integrity, loss of negative air or high air particulate count must be reported to the COTR immediately.
P. A clean temporary corridor from the central corridor at the construction site entrance to the ADP closet must be maintained and unobstructed at all times, and shall be isolated from other construction activity. Necessary provisions shall be mandated to maintain clean, filtered air to the ADP closet in addition to protecting existing communications services, racks and wiring. ADP functions must remain fully operational throughout construction.

The following are examples of other methods which may be requested as appropriate to specific tasks and circumstances:

1. Water misting of work surfaces to control dust during cutting, sweeping, and tasks which generate dust.
2. Shutting down or covering air vents to construction areas during demolition activities prior to the beginning of construction and for the duration of the project.
3. Using a ceiling access procedure with a mini-enclosure around the work area when construction activities are required outside of the construction site.
4. Sealing all construction, holes, pipes, conduits, punctures, and/or exposures appropriately.
5. Requiring workers to wear clean shoe covers each time they exit the work site when they travel to another area of the facility is necessary.
6. When appropriate, construction barricade entrances will have gasketed doors with self-closing, latching hardware, and dampened wall-off mats.

Environmental Cleaning

1. Any dust tracked outside of the barrier must be removed immediately and as it accumulates.

2. Cleaning in construction areas will be accomplished so as to minimize aerosolizing dust particles and may include use of resin control, damp mop, moist broom and /or HEPA filtered vacuum cleaner. Shovels and broader methods may be used to remove large debris.
3. Debris removal from construction sites must be by a pre-determined route.
4. Debris will be transported in clean containers with tight fitting covers.
5. When construction is complete, a thorough clean up of the area is to be done by construction personnel prior to turnover to Facilities Management Services for final cleaning and dust barrier removal.
6. The contractor will ensure that gross soiling is removed prior to removal of barriers.
7. Facilities Management Services will treat barriers as debris (above) and remove them in a manner designed to minimize distribution of particles.
8. Thorough final cleaning of all surfaces will be done by Facilities Management Services before the area is used to provide patient care.

VA MEDICAL CENTER
Infection Control Program

INFECTION CONTROL FOR CONSTRUCTION WORKERS

WHY INFECTION CONTROL IS IMPORTANT

Hospital-acquired infections (nosocomial) affect 5 percent of all patients admitted to hospitals in the United States and can cause significant illness or even death. Not all of these infections are preventable; however, studies show that up to 32 percent of hospital acquired infections can be prevented when hospitals employ an active and effective infections control program. Hospitals patients are at risk for infection because the stresses of illness and invasive treatments weaken their immune system. In general, healthy adults who are to be at work do not have the same risk for acquiring infections.

Our Infection Control Program is designed to identify and control situations that carry an increased risk for infection and to provide for a safe and healthful environment for patients and staff. During the construction project, you may be asked to do some things a bit differently to ensure that the environment is maintained as safe as possible for all. This information was developed through collaboration with the Infection Control Coordinator, Chief FMS, Safety Officer and Industrial Hygienist to help in explaining infection control aspects of construction in the hospital setting.

DUST CONTROL POLICY

- Divert airflow construction area to exhaust; add filtering to remove dust before it enters the exhaust air system. Block off supply grills closed and covered) to reduce contamination.

- Install impervious barriers from floor to floor slab above and wall to wall using framing, clips and duct tape as required to maintain and secure the barrier seal.

- Report disruptions such as holes in the barrier and interruptions in the seal to the COTR immediately.

- Place the “air moving and filtration device” into the containment area and operate to remove dust particles from the air.

- Negative air pressure will always be maintained in the construction site at all times during construction.

- If work is in an extremely sensitive area such as the Operating Room, double barriers may be required.

- Project site must be completely contained before work begins and all penetrations into the construction site must be sealed. Windows must be closed and air ducts shut down or taped.

- Anterooms (consisting of confined space beyond the barriers) will be provided at entrances to the work area to contain debris and provide an area where workers can remove protective clothing or vacuum off personal clothing except when exiting directly to the outside of the building.

- Walk-off mats will be at entrances to work areas during construction.

- Traffic routes will be pre-determine and traffic to and from the construction site will be minimized.

ENVIRONMENTAL CLEANING POLICY

- Any dust tracked outside the barriers must be removed immediately as it accumulates.

- All cleaning in the construction area will be by damp method or HEPA filtered vacuum.

- Debris will be removed by a pre-determined route and transported in clean, covered containers.

- At the end of each construction shift, construction personnel will do a thorough clean up of the area.

- After inspection, the contractor will remove barriers.

- Environmental Services will do a thorough final cleaning.

Refer to “Infection Control Manual VAMC” for additional control and cleaning precautions and procedures.

VA MEDICAL CENTER
INFECTION CONTROL PROGRAM

INFECTION CONTROL COMPLIANCE CHECKLIST

Project: _____ Date:_____

Time Start: _____ Time End: _____

The following are checked at least daily during demolition and/or construction:

1. Barrier containment competed before construction began.
2. Negative air pressure at construction site was monitored and recorded, at least daily, during construction work.
3. Air particulate counter has been established at construction site entrance, monitored and recorded at least daily during construction work.
4. Construction area air exhausted directly outside or HEPA filtered to remove dust before the return to the HVAC system.
5. Air moving and HEPA filtration device placed into the construction area to remove and prevent the escape of dust and fungal particles.
6. All construction holes, pipes, conduits, punctures and/or exposures appropriately sealed.
7. Containment and construction barriers provided at and from ADP closet throughout construction.
8. Construction workers put on coveralls for entering the work site or vacuum off work clothes with a HEPA vacuum cleaner prior to exiting the work area.
9. Work surfaces water-misted to control dust while cutting.
10. Dust mats placed at entrance to work area at all times.
11. Workers wore clean shoe covers each time they exited the work area to travel to other areas of the facility (or no travel to other areas was necessary).
12. Dust tracked outside the barrier was removed immediately by damp-mop method or with HEPA filtered vacuum cleaners.
13. Debris was transported from the construction area by the pre-determined route in clean containers with tight-fitting covers.
14. Designated debris routes were cleaned by damp-mop method or with HEPA filtered vacuum cleaners prior to being returned to patient or staff use.
15. Any disruption or violation of the containment barrier integrity was immediately reported to the Project Manager.
16. The freight elevator should not transport supplies or contractors to the 7th floor. All contractors will exit on the 6th floor to minimize traffic going to the 7th floor.

Above items checked (by initials) at the following times:

_____ _____ _____ _____

_____ _____ _____ _____

Compliance Checklist Submitted By:_____

COMMENTS:

_____

SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 GENERAL INTENTION

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Pathology HVAC Corrections, #689-08-102, VA Medical Center, West Haven, CT, as required by drawings and specifications.

B. Visits to the site by Bidders may be made at pre-bid walk-through and by appointment with the Medical Center Engineering Officer

C. Offices of van Zelm Engineers, 10 Talcott Notch Road, Farmington, CT 06032, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.

D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the Contracting Office Technical Representative (COTR) in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the Project Engineer (PE).

E. All employees of General Contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.

F. Prior to commencing work, General Contractor shall provide proof that a OSHA certified “competent person” (CP) (29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the general or subcontractors are present. The length of training is based on the project hazards and complexity, State and Federal regulations and VA requirements.

G. Training:

1. All employees of General Contractor or subcontractors shall have the 30-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team. Competent employees include Project Superintendents, Construction Foremen, Lead Supervisory personnel. All other workers

will require evidence of a minimum training level equal to a certified OSHA 10 safety orientation plus any specialized training specific to the job hazard analysis for their assigned work.

2. Submit training records of all such employees for approval before the start of work.

1.2 STATEMENT OF BID ITEM(S)

A. ITEM 1, GENERAL CONSTRUCTION: Work includes general construction, alterations, roofing, mechanical, plumbing, fire protection and electrical work, asbestos abatement, lead removal, laboratory equipment, utility systems, necessary removal of existing structures and construction and certain other items.

B. Deduct ALTERNATE NO. 1: Value of ITEM 1 less the value of not to renovate rooms 1174, 1175, 1180 & 1182 (Existing AP Lab space). This shall include deduct costs associated with wall patch and repair, remaining fume hood exhaust ductwork and exhaust fan removal, painting, making safe existing power connections and other services noted in the contract documents. Existing casework shall remain.

C. Deduct ALTERNATE NO. 2: Value of ITEM 1 less the value of material costs for furniture and fume/containment hoods from contract.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

A. All specifications and drawings will be furnished electronically.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor’s employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. For working outside the “regular hours” as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.

3. No photography of VA premises is allowed without written permission of the Contracting Officer.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COTR for the purpose of security inspections. Construction Barriers within the facility will be keyed to the VA master key system, insure all locks, lock sets are capable to receive a Yale 1210 6-pin removable key core. Cores and keys will be supplied by the government.
2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

D. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
4. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
5. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
6. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
7. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
8. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).

a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.

b. “Sensitive information” including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

E. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only.
3. No permits shall be issued for sub-contractor forces. Sub-contractors shall park along the north-east fence area in parking lot 10-12 or as specified by the COTR.
4. Contractors shall post the contractor name and project title on the window with an 8.5”x11” sheet of paper.
5. Contractor found parking in patient or other areas shall be ticketed by the VA Police. The Contractor will not be allowed to park next to the building.
6. Contractors shall not park on grass areas or in fenced areas outlined in the Contract Documents.
7. No weapons shall be allowed on VA Property. Contractor will be requested to immediately leave the property. Failure to do so will involve VA Police escorting the violator off VA Property.
8. No alcoholic beverages or drugs are allowed on VA Property. If found in violation the violator shall be requested to leave the VA property immediately. Failure to do so will involve VA Police escorting the violator off VA Property.

F. Security Clearances and Identity Badge Requirements;

1. In accordance with FAR Clause 52.204-9 titled Personal Identity Verification of Contractor personnel, this solicitation requires long-term logical and/or physical access to VA Connecticut Healthcare System. In order to obtain a PIV card, the following guidelines are to be followed.
2. Contractor Personnel Security Requirements

a) All Contractor employees who require long term logical and/or physical access to VA Connecticut Healthcare System shall be subject to a background investigation and must receive a favorable

adjudication. This requirement is applicable to all subcontractor personnel requiring the same logical and/or physical access. If the background investigations are not completed prior to the start date of the contract, the Contractor shall be responsible for the actions of those personnel providing services at VA Connecticut Healthcare System.

3. Background Investigation

a) The Contractor shall bear the expense of obtaining background investigations. If payment for investigation is required to be paid in advance, payment will be made by VA and the Contractor shall reimburse VA within thirty (30) days.

b) The Contractor shall prescreen all personnel requiring access to the computer systems to ensure they maintain a U.S. citizenship and are able to read, write, speak and understand the English language.

c) The Contractor must provide the Contracting Officer the name, address, SSN, date of birth, place of birth (city, state & country), and email address of each individual who will be providing services to the VA under the contract. Please send info to the Contracting Officer at:
A&MMS 950 Campbell Ave., West Haven, CT 06516. Attn of: Deane Bruce.

d) The Contracting Officer shall provide VA Form 0711 to the Contractor for completion. The completed form shall be returned to the Contracting Officer within three (3) work days.

e) The Contractor’s employees will be required to report to VA’s Human Resources service (Bldg 4, Room D-116) prior to their first day or on the first day they are required to report on station. They must have two forms of ID and may be required to provide such things as their name, address, social security number, etc. They will also be fingerprinted at this time.

f) The Contractor will then be contacted by the VA Law Enforcement Training Center in North Little Rock, Arkansas. The VA Law Enforcement Training Center will advise the Contractor as to what is needed to complete the background investigation and where to send all the supporting documentation. Upon initial notification from the VA Law Enforcement Training Center, the Contractor shall be required to submit all supporting documentation to North Little Rock, Arkansas within 21 calendar days.

g) The Contractor, when notified of an unfavorable determination, shall withdraw the employee from consideration from working under the contract.

h) Failure to comply with the contractor personnel security requirements may result in termination of the contract for default.

i) Any ID badges the Contractor employee receives from VA must be returned to VA upon contract completion or Contractor's employee term for providing services. If ID badge is not returned Contractor will be required to pay VA $500 for each unreturned badge.

1.5 FIRE SAFETY

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):
   E84-2008.....Surface Burning Characteristics of Building Materials
2. National Fire Protection Association (NFPA):
   10-2006.....Standard for Portable Fire Extinguishers
   30-2007.....Flammable and Combustible Liquids Code
   51B-2003.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
   70-2007.....National Electrical Code
   241-2004.....Standard for Safeguarding Construction, Alteration, and Demolition Operations
3. Occupational Safety and Health Administration (OSHA):
   29 CFR 1926.....Safety and Health Regulations for Construction

B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COTR and Facility Safety Manager for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Prior to any worker for the Contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the General Contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc.

Documentation shall be provided to the COTR that individuals have undergone Contractor's safety briefing.

C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).

E. Temporary Construction Partitions:

1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas, the areas that are described in phasing requirements and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
2. Install one-hour for horizontal separation and two-hour for vertical separation, fire-rated temporary construction partitions as shown on drawings and/or as required to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING. Penetrations shall not be left temporarily open.

F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COTR and facility Safety Officer.

H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COTR and facility Safety Officer.

I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30. All Material Safety Data Sheets shall be submitted to the COTR & Safety Officer prior to being brought on site.

K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinkler or Contractor shall provide suitable fire protection and detection systems as required to constantly protect the space.

L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with COTR and facility Safety Officer. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the Medical Center and copies provided to the COTR. The existing fire service shall be extended to the construction fencing where the Siamese connection will be located. Access to Siamese connection shall be maintained at all times without exception. Installation of temporary fire service shall be installed in accordance with all local and state codes and approved by Authorities Having Jurisdiction (AHJ).

M. Smoke Detectors: Prevent accidental operation. Contractor shall contract with Simplex-Tyco of East Berlin at 860-438-3200 the VA service vendor to disable, in-able, modify and/or extend system as required to maintain fire protection. Coordinate with COTR and facility Safety Officer.

N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COTR. Obtain permits from facility Safety Officer at least 24 hours in advance.

O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COTR and facility Safety Officer.

P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas as indicated in Section 01 74 19, CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

R. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

S. Contractor shall provide necessary signage and make necessary changes to EXIT signage as required to ensure egress and safety.

T. Contractor shall submit documentation to the COTR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.6 OPERATIONS AND STORAGE AREAS

A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

D. Working space and space available for storing materials shall be as determined by the COTR.

E. Workmen are subject to rules of Medical Center applicable to their conduct.

F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of

utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by the COTR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.
2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

G. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by the COTR. All such actions shall be coordinated with the Utility Company involved:

1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

H. Phasing: To insure such executions, Contractor shall furnish the COTR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COTR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to insure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, COTR and Contractor, as follows:

Phase I:

Scope of work shall include, but not limited to, provisions to seal off, construct temporary corridor to main corridor beyond construction entrance, protect existing ADP closet services, racks and wiring to accomplish demolition work and asbestos abatement. This shall also include temporary power to support UPS; shutdown to be coordinated with

COTR. Upon completion of demolition and asbestos abatement work, full containment of room shall be achieved, with proper air filtration and cooling/ventilation to support functions throughout the entire construction project. A security access door shall be provided at the entrance to the room and shall be limited only to authorized individuals as determined by the COTR.

Phase II:

Scope of work shall consist of complete demolition and fit-out of new Reverse Osmosis/De-ionized (RODI) water storage room located in the present Pathology space; located on the first floor West Wing of Building #1. RODI system shall be partially relocated from current location in Histology/Microscopy space. Refer to contract documents for additional information.

Phase III:

Scope of work shall consist of complete demolition and asbestos abatement of the new Anatomic Pathology (AP) Suite located on the first floor southwest wing of Building 1. Additionally, scope of work shall include partial and selective demolition and asbestos abatement of the existing ground floor Urology Suite directly below the new AP Suite.

Phase IV:

Scope of work shall consist of full renovation of current Histology/ Microscopy space to accommodate relocation of existing AP suite. Renovations shall be complete in every respect including testing and balancing, acceptance of completion prior to owner occupancy. Once owner has taken occupancy, the existing AP Suite shall be upgraded to include patch and repair work, painting, demolition of existing ductwork, etc. Refer to contract documents and Deduct ALTERNATE #1 for additional information.

I. Building No. 1 South West Wing will be vacated by Government in accordance with above phasing beginning immediately after date of receipt of Notice to Proceed and turned over to Contractor.

1. All remaining areas of Building No. 1 will be occupied by Medical Center personnel during periods of Phase I, II, III and IV. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment.

Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

2. Immediate areas of alterations not mentioned in preceding Subparagraph 1 will be temporarily vacated while alterations are performed.

J. When the building is turned over to Contractor, Contractor shall accept entire responsibility therefore.

1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Safety Section and Department of Veterans Affairs Police whichever will be required to respond to an alarm from Contractor's employee or watchman.

K. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by the COTR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of the COTR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director’s prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, for additional requirements.
2. Contractor shall submit a request to interrupt any such services to COTR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time

approved by Medical Center may occur at other than normal working hours.

4. Major interruptions of any system must be requested, in writing, at least 30 calendar days prior to the desired time and shall be performed as directed by the COTR.
5. In case of a contract construction emergency, service will be interrupted on approval of COTR. Such approval will be confirmed in writing as soon as practical.
6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

M. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.

N. Coordinate the work for this contract with other construction operations as directed by the COTR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

O. Coordinate the work for this contract with other construction operations as directed by the COTR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.7 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COTR and a representative of VA Supply Service, of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, by all three, to the Contracting Officer. This report shall list by rooms and spaces:

1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of building.
2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
3. Shall note any discrepancies between drawings and existing conditions at site.
4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and the COTR.

B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of the COTR and/or Supply Representative, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).

C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and the COTR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:
   1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.

D. Protection: Provide the following protective measures:
   1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
   2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.

3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 INFECTION PREVENTION MEASURES

A. Implement the requirements for Class III and Class IV control measures of the VAMC's Infection Control Risk Assessment (ICRA) team. The Contractor shall monitor dust in the vicinity of the construction work and the Contractor shall take corrective action immediately if the safe levels are exceeded. The Contractors shall:

B. Establish and maintain a dust control program as part of the Contractor's infection preventive measures in accordance with the guidelines provided as specified here. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to the COTR and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES and Section 01 35 26, GOVERNMENTAL SAFETY REQUIREMENTS.

1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the Medical Center.
2. All personnel shall show evidence of TB screening to ensure that personnel do not have nor carry TB.
3. All personnel shall fill out the Healthcare Questionnaire form supplied by the Contracting Officer at the pre-construction conference.

C. Contractor Site Safety and Health Officer (SSHO) shall monitor for dust and airborne particulate as appropriate during construction. A baseline of conditions shall be established by the Contractor prior to the start of work and weekly during the construction stage to determine impact of construction activities on indoor air quality. Contractor shall provide particulate monitors with a range of 0.001 to 10 mg/m3 with a resolution of 0.001 mg/m3 and 0.01 to 100 mg/m3. Data logger shall have a digital read out and have the capability for extracting data for reports to be provided weekly showing hourly readings with high alarm out puts. Reports shall include daily pressure readings and particulate reports to insure compliance to maintaining a proper negative pressure and dust barrier throughout the entire project. In addition:

1. The COTR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zones, research labs and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in all construction zones shall be maintained at all times. Upon notification, the Contractor shall implement corrective measures to restore proper pressure differentials as needed.

D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.

1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by the COTR. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction. The method of capping ducts shall be dust tight and withstand airflow.
2. Do not perform dust producing tasks within occupied areas without the approval of the COTR. For construction in any areas that will remain jointly occupied by the Medical Center and Contractor’s workers, the Contractor shall:
   a. Obtain an infection control permit before beginning construction in an area.
   b. Provide dust proof one-hour for horizontal and two-hour for vertical openings, fire-rated temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, with a secondary barrier for decon and to allow worker access. Maintain negative air at all times. A fire retardant polystyrene, 6-mil thick or greater plastic outer barrier shall meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the COTR and Medical Center.
   c. Complete all critical barriers or implement control cube method before construction begins in an area.
   d. HEPA filtration is required where the exhaust dust may re-enter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at

99.9% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other pre-filter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the Medical Center.

e. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24” x 36”), shall be used at all interior transitions from the construction area to occupied Medical Center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.

f. Seal holes, pipes, conduits and penetrations appropriately to maintain negative pressure and dust containment.

g. Vacuum and wet mop with disinfectant all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.

h. The Contractor shall not haul debris through patient-care areas without prior approval of the COTR and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

i. Construct anteroom-vestibule and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving the work site or the workers shall wear paper over-alls that are removed each time they leave the work site.

j. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.

k. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within

the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

l. Wet mop area with disinfectant and wipe surfaces with disinfectant prior to release of area. Appropriate disinfectants include a dilution of bleach solution and or a EPA registered tuberculcides (list B), products registered by EPA (List A), products registered against HIV/HBV (List D).” As extracted from the Blood born Pathogen standard and by reference in CPL-02-02-069-CLP2-2-.69 Enforcement Procedures for the standard.

m. Do not remove barriers from select areas until the complete area is cleaned by VA Environmental Management Services. Coordinate with the COTR.

n. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

E. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new and existing air ducts shall be cleaned prior to final inspection.

1.9 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:

1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed the COTR.
2. Items not reserved shall become property of the Contractor and be removed by Contractor from the Medical Center.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain

the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

4. PCB lighting ballasts: The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) lighting ballasts . The light fixtures shall be taken apart to examine the ballasts. If PCB ballasts are found they shall be put in barrels supplied by the VA Safety Section and handled in accordance with the procedures of the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) as outlined in Code of Federal Regulation (CFR), Titled 40 and 49 respectively. The EPA's Toxic Substance Control Act (TSCA) Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7 also apply.
   a. Copies of the following listed CFR titles may be obtained from the Government Printing Office:
      40 CFR 261.....Identification and Listing of Hazardous Waste
      40 CFR 262.....Standards Applicable to Generators of Hazardous Waste
      40 CFR 263.....Standards Applicable to Transporters of Hazardous Waste
      40 CFR 761.....PCB Manufacturing, Processing, Distribution in Commerce, and use Prohibitions
      49 CFR 172.....Hazardous Material tables and Hazardous Material Communications Regulations
      49 CFR 173.....Shippers - General Requirements for Shipments and Packaging
      49 CRR 173.....Subpart A General
      49 CFR 173.....Subpart B Preparation of Hazardous Material for Transportation
      49 CFR 173.....Subpart J Other Regulated Material; Definitions and Preparation
      TSCA.....Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7

1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor

shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

1.11 RESTORATION

A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COTR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COTR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing

piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.

D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2) of Section 00 72 00, GENERAL CONDITIONS.

1.12 AS-BUILT DRAWINGS

A. The Contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.

B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COTR’s review, as often as requested.

C. Contractor shall deliver two approved completed sets of as-built drawings to the COTR within 15 calendar days after each completed phase and after the acceptance of the project by the COTR.

D. Contractor shall refer to Sections 01 78 00 CLOSEOUT SUBMITTALS AND 01 78 23 OPERATIONS & MAINTENANCE DATA for additional requirements.

E. Paragraphs A, B, C & D shall also apply to all shop drawings.

1.13 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COTR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.

1.14 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:

1. Permission to use each unit or system must be given by the COTR. If the equipment is not installed and maintained in accordance with the

following provisions, the COTR will withdraw permission for use of the equipment.

2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.

C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.15 TEMPORARY USE OF EXISTING ELEVATORS

A. Use of existing service elevator for handling building materials and Contractor's personnel will be permitted subject to following provisions:

1. Contractor makes all arrangements with the COTR for use of elevators. The COTR will ascertain that elevator is in proper condition. Contractor may use elevator Number S3 in Building No. 2 for daily use between the hours of 4pm to 8am and for special nonrecurring time intervals when permission is granted. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.
2. Contractor shall provide covers and provide maximum protection of following elevator components:
   a. Entrance jambs, heads soffits and threshold plates.

b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
c. Finish flooring.

3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, stones, etc., during temporary use, they shall be removed and replaced by new hoisting ropes.
4. If brake lining of elevators are excessively worn or damaged during temporary use, they shall be removed and replaced by new brake lining.
5. All parts of main controller, starter, relay panel, selector, etc., worn or damaged during temporary use shall be removed and replaced with new parts, if recommended by elevator inspector after elevator is released by Contractor.
6. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.

1.16 TESTS

A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc.
D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.

E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.17 INSTRUCTIONS

A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and per Section 01 78 73 OPERATIONS & MAINTENANCE DATA and as hereinafter specified.

B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the COTR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COTR and

shall be considered concluded only when the COTR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COTR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.18 TEMPORARY TOILETS

A. Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary dry toilet accommodations. Keep such places clean and free from flies and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

1.19 CONSTRUCTION DIGITAL IMAGES

A. During the construction period through completion, furnish Department of Veterans Affairs with 200 views of digital images on one Compact Disc (CD).

B. Images on CD-ROM shall be recorded in JPEG format with a minimum of 24 bit color and no reduction in actual picture size. Compressed size of the file shall be no less than 80% or the original with no loss of information. File names shall contain the date the image was taken, the Project number and a unique sequential identifier. The CD-ROM shall also contain an index of all the images contained therein in either a TXT or Microsoft Word format.

C. Interior Final Photos: After completion of all work in an area final interior photos will be taken. The camera must allow the colors to be as close as possible to the actual colors. For number and location of views, see Section 09 06 00, SCHEDULE FOR FINISHES. View shall be taken after final completion of work. The images shall also be provided on a CD to the COTR Office.

1.20 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:

1. Permission to use each unit or system must be given by the COTR. If the equipment is not installed and maintained in accordance with the following provisions, the COTR will withdraw permission for use of the equipment.
2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to

the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.

3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.

C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.21 AVAILABILITY AND USE OF UTILITY SERVICES

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.

B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the

Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.

D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:

1. Obtain heat by connecting to Medical Center heating distribution system.

E. Electricity (for Construction and Testing): Furnish all temporary electric services.

1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.

F. Water (for Construction and Testing): Furnish temporary water service.

1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at the COTR’s discretion) of use of water from Medical Center's system.

1.22 EXTENSION OF EXISTING TELEPHONE EQUIPMENT

A. The Contractor shall coordinate with the work of installation of an extension of the existing telephone equipment. This work shall be completed before the space is turned over to VA.

1.23 GOVERNMENT-FURNISHED PROPERTY

A. The Government shall deliver to the Contractor, the Government-furnished property shown on the Schedule and or drawings.

B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.

C. Contractor shall be prepared to receive this equipment from Government and store or place such equipment not less than 90 days before Completion Date of project.

D. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.

1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.

E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.

F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.

G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.24 RELOCATED EQUIPMENT ITEMS

A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.

B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COTR.

C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines

in finished areas and cap as specified herein before under paragraph "Abandoned Lines".

D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.

E. Contractor shall employ services of an installation engineer, who is an authorized representative of the manufacturer of this equipment to supervise assembly and installation of existing equipment, required to be relocated.

F. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.25 SAFETY SIGN

A. Provide a Safety Sign where directed by the COTR. Face of sign shall be 19 mm (3/4 inch) thick exterior grade plywood. Provide two 100 mm by 100 mm (four by four inch) posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.

B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.

C. Maintain sign and remove it when directed by the COTR.

E. Post the number of accident free days on a daily basis.

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SECTION 01 32 16
NETWORK ANALYSIS SCHEDULES

PART 1- GENERAL

1.1 DESCRIPTION:

A. The Contractor shall develop a Network Analysis System (NAS) plan and schedule demonstrating fulfillment of the contract requirements, shall keep the network up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) Precedence Diagramming Method (PDM) technique will be utilized to satisfy both time and cost applications. All schedule data and reports required under this specification section shall be based upon regular total float, not relative total float schedules.

1.2 CONTRACTOR'S REPRESENTATIVE:

A. The Contractor shall designate an authorized representative in the firm who will be responsible for the preparation of the network diagram, review and report progress of the project with and to the Contracting Officer's representative.

B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section and such authority shall not be interrupted throughout the duration of the project.

1.3 CONTRACTOR'S CONSULTANT

A. To prepare the network diagram, and compact disk(s), which reflects the Contractor's project plan, the Contractor shall engage an independent CPM consultant who is skilled in the time and cost application of scheduling using (PDM) network techniques for construction projects, the cost of which is included in the Contractor's bid. This consultant shall not have any financial or business ties to the Contractor, and shall not be an affiliate or subsidiary company of the Contractor, and shall not be employed by an affiliate or subsidiary company of the Contractor.

B. Prior to engaging a consultant, and within 10 calendar days after award of the contract, the Contractor shall submit to the Contracting Officer:
   1. The name and address of the proposed consultant.
   2. Sufficient information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.

3. A list of prior construction projects, along with selected PDM network diagram samples on current projects which the proposed consultant has performed complete project scheduling services. These network diagram samples must show complete project planning for a project of similar size and scope as covered under this contract.

C. The Contracting Officer has the right to approve or disapprove employment of the proposed consultant, and will notify the Contractor of the VA decision within seven calendar days from receipt of information. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor must have their CPM Consultant approved prior to submitting any diagram.

1.4 COMPUTER PRODUCED SCHEDULES

A. The contractor shall provide to the VA, Senior Resident Engineer and CPM Schedule Analyst, monthly computer processing of all computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of Primavera (P3) to the contracting officer’s representative; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data in Primavera (P3) batch format; and the resulting monthly updated schedule in a compressed electronic file in Primavera (P3), (PDM) format. These must be submitted with and substantively support the contractor’s monthly payment request and the signed lookahead report. The resident engineer shall identify the five different report formats that the contractor shall provide based upon the monthly schedule updates.

B. The contractor is responsible for the correctness and timeliness of the computer-produced reports. The Contractor is also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.

C. The VA shall report errors in computer-produced reports to the Contractor’s representative within ten calendar days from receipt of reports. The Contractor will reprocess the computer-produced reports and associated compact disk(s), when requested by the Contracting Officer’s representative, to correct errors which affect the payment and schedule for the project.

1.5 THE COMPLETE PROJECT NETWORK DIAGRAM SUBMITTAL

A. Within 45 calendar days (60 calendar days on projects over $50,000,000) after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the complete network diagram on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in a compressed Primavera (P3), (PDM) format. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, duration, predecessor and successor relationships, trade code, area code, description, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start and start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer’s written approval before incorporating them into the network diagram. The Contracting Officer’s separate approval of the network diagram shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have a zero duration. The complete working network diagram shall reflect the Contractor's approach to scheduling the complete project. The final network diagram in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the Contractors as bid schedule. These changes/delays shall be entered at the first update after the final network diagram has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

B. Within 30 calendar days after receipt of the complete project network diagram, the Contracting Officer or his representative will do one or both of the following:

   1. Notify the Contractor concerning his actions, opinions, and objections.

2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised network diagram, three copies of the revised computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

C. The approved baseline network diagram schedule and the corresponding computer-produced schedule(s) shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.

1.6 WORK ACTIVITY/EVENT COST DATA

A. The Contractor shall cost load all work activities/events except procurement activities. The cost loading shall reflect the appropriate level of effort of the work activities/events. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. In the event of disapproval, the Contractor shall revise and resubmit in accordance with Article, THE COMPLETE PROJECT NETWORK DIAGRAM SUBMITTAL. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.

B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in the General Conditions, Article, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (VA GENERAL CONDITIONS).

C. In accordance with Article PERFORMANCE OF WORK BY THE CONTRACTOR in the Section 00 72 00, GENERAL CONDITIONS, the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events (referred to as "branches" in the Section 00 72 00

GENERAL CONDITIONS) of the project for which the Contractor's forces will perform the work.

D. The Contractor shall cost load work activities/events for ASBESTOS ABATEMENT. The sum of asbestos abatement work activity/event costs shall equal the value of the asbestos bid item in the Contractors' bid.

E. The Contractor shall cost load work activities/events for all BID ITEMS. The sum of the cost loading for each bid item work activities/events shall equal the value of the item in the Contractors' bid.

F. Work activities/events for Contractor bond shall have a trade code and area code of BOND.

1.7 NETWORK DIAGRAM REQUIREMENTS

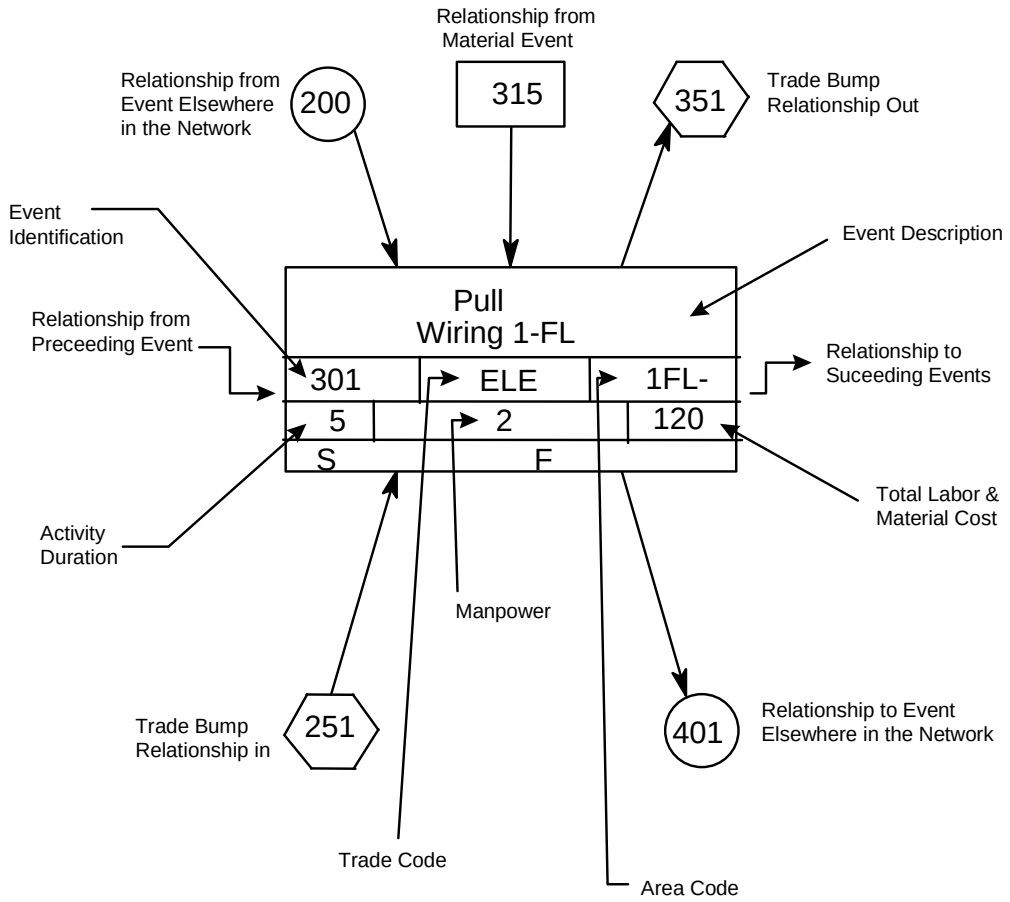
A. Show on the network diagram the sequence and interdependence of work activities/events required for complete performance of all items of work. In preparing the network diagram, the Contractor shall:

1. Exercise sufficient care to produce a clear, legible and accurate network diagram, refer to the drawing, CPM-1 (Sample CPM Network). Computer plotted network diagrams shall legibly display and plot all information required by the VA CPM activity/event legend or the computer plotted network diagram will not be acceptable. If the computer plotted network diagram is not found acceptable by the contracting officer’s representative, then the network diagram will need to be hand drafted and meet legibility requirements. Group activities related to specific physical areas of the project, on the network diagram for ease of understanding and simplification. Provide a key plan on each network diagram sheet showing the project area associated with the work activities/events shown on that sheet.
2. Show the following on each work activity/event:
   a. Activity/Event ID number.
   b. Concise description of the work represented by the activity/event. (35 characters or less including spaces preferred).
   c. Performance responsibility or trade code (five alpha characters or less): GEN, MECH, ELEC, CARP, PLAST, or other acceptable abbreviations.
   d. Duration (in work days.)
   e. Cost (in accordance with Article, ACTIVITY/EVENT COST DATA of this section and less than $9,999,999 per activity).
   f. Work location or area code (five characters or less), descriptive of the area involved.
   g. Manpower required (average number of men per day).

h. The SYMBOL LEGEND format shown below and on the drawing, CPM-1 (Sample CPM Network) is mandatory and shall be followed in preparing final network diagrams.

SYMBOL LEGEND

Show Network Diagram page number location(s) for all incoming/outgoing node connector(s).



3. Show activities/events as:
   a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
   b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
   c. Interruption of VA Medical Center utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.

d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase. Schedule these activities/events so that only one phase is scheduled for completion within the same 30 consecutive calendar day period (except for those phases immediately preceding the final acceptance). Maintain this scheduling condition throughout the length of the contract unless waived by the Contracting Officer’s representative in writing.
f. Work activities/events for the asbestos abatement bid item shall have a trade code of ASB.
g. Bid items other than the Base Bid (ITEM 1) and Asbestos Abatement item shall have trade codes corresponding to the appropriate bid item number (e.g., ITM 3, ITM 4 and other items).

4. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
5. Break up the work into activities/events of a duration no longer than 20 work days each, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the Contracting Officer may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals shall not be less than 20 work days. Refer to drawing CPM-1 for VA approval activities/events which will require minimum duration longer than 20 workdays. The construction time as determined by the CPM schedule from early start to late finish for any sub-phase, phase or the entire project shall not exceed the contract time(s) specified or shown.
6. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.

7. Uniquely number each activity/event with numbers ranging from 1 to 99998 only. The network diagram should be generally numbered in such a way to reflect either discipline, phase or location of the work.

B. Submit the following supporting data in addition to the network diagram, activity/event ID schedule and electronic file (s). Failure of the Contractor to include this data will delay the review of the submittal until the Contracting Officer is in receipt of the missing data:
   1. The proposed number of working days per week.
   2. The holidays to be observed during the life of the contract (by day, month, and year).
   3. The planned number of shifts per day.
   4. The number of hours per shift.
   5. List the major construction equipment to be used on the site, describing how each piece relates to and will be used in support of the submitted network diagram work activities/events.
   6. Provide a typed, doubled spaced, description, at least one page in length, of the plan and your approach to constructing the project.

C. To the extent that the network diagram or any revised network diagram shows anything not jointly agreed upon, it shall not be deemed to have been approved by the Contracting Officer. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the Contracting Officer's approval of the network diagram.

D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA (Senior resident Engineer and CPM Schedule Analyst) an electronic file(s) containing one file of the data required to produce a Primavera (P3), (PDM) produced schedule, reflecting all the activities/events of the complete project network diagram being submitted.

1.8 PAYMENT TO THE CONTRACTOR:

A. Monthly, the contractor shall submit the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of Section 00 72 00, GENERAL CONDITIONS. The Contractor is entitled to a monthly progress payment upon approval of estimates as determined from the currently approved

updated computer-produced calendar-dated schedule unless, in special situations, the Contracting Officer permits an exception to this requirement. Monthly payment requests shall include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of Primavera (P3), (PDM) to the contracting officer’s representative; a listing of all project schedule changes, and associated data, made at the update; and an electronic file (s) of the resulting monthly updated schedule in a compressed Primavera (P3), (PDM) format. These must be submitted with and substantively support the contractor’s monthly application and certificate for payment request documents.

B. When the Contractor fails or refuses to furnish to the Contracting Officer the information and the associated updated Primavera (P3), (PDM) schedule in electronic format, which, in the sole judgment of the Contracting Officer, is necessary for processing the monthly progress payment, the Contractor shall not be deemed to have provided an estimate and supporting schedule data upon which progress payment may be made.

1.9 PAYMENT AND PROGRESS REPORTING

A. Monthly job site progress meetings shall be held on dates mutually agreed to by the Contracting Officer (or Contracting Officer's representative) and the Contractor. Contractor and the CPM consultant will be required to attend all monthly progress meetings. Presence of Subcontractors during progress meeting is optional unless required by the Contracting Officer (or Contracting Officer's representative). The Contractor shall update the project schedule and all other data required by this section shall be accurately filled in and completed prior to the monthly progress meeting. The Contractor shall provide this information to the Contracting Officer or the VA representative in completed form three work days in advance of the progress meeting. Job progress will be reviewed to verify:

1. Actual start and/or finish dates for updated/completed activities/events.
2. Remaining duration, required to complete each activity/event started, or scheduled to start, but not completed.
3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the network diagram and computer-produced schedules. Changes in activity/event sequence and duration which have been made pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.

4. Percentage for completed and partially completed activities/events.
5. Logic and duration revisions required by this section of the specifications.
6. Activity/event duration and percent complete shall be updated independently.

B. The Contractor shall submit a narrative report as a part of his monthly review and update, in a form agreed upon by the Contractor and the Contracting Officer. The narrative report shall include a description of problem areas; current and anticipated delaying factors and their estimated impact on performance of other activities/events and completion dates; and an explanation of corrective action taken or proposed. This report is in addition to the daily reports pursuant to the provisions of Article, DAILY REPORT OF WORKERS AND MATERIALS in the GENERAL CONDITIONS.

C. After completion of the joint review and the Contracting Officer's approval of all entries, the contractor will generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer’s representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.

D. After completing the monthly schedule update, the contractor’s scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and resident engineer for the contract change(s). When there is a disagreement on logic and/or durations, the consultant shall use the schedule logic and/or durations provided and approved by the resident engineer. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the resident engineer within fourteen (14) calendar days of completing the regular schedule update. Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update

periods. This will require detailed record keeping for each of the manual progress payment updates.

E. After VA acceptance and approval of the final network diagram, and after each monthly update, the contractor shall submit to the Contracting Officer three blue line copies of a revised complete network diagram showing all completed and partially completed activities/events, contract changes and logic changes made on the intervening updates or at the first update on the final diagram. The Contracting Officer may elect to have the contractor do this on a less frequent basis, but it shall be done on a quarterly basis as a minimum.

F. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

1.10 RESPONSIBILITY FOR COMPLETION

A. Whenever it becomes apparent from the current monthly progress review meeting or the monthly computer-produced calendar-dated schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
   1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
   2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
   3. Reschedule the work in conformance with the specification requirements.

B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the Contracting Officer for the proposed

schedule changes. If such actions are approved, the CPM revisions shall be incorporated by the Contractor into the network diagram before the next update, at no additional cost to the Government.

1.11 CHANGES TO NETWORK DIAGRAM AND SCHEDULE

A. Within 30 calendar days after VA acceptance and approval of any updated computer-produced schedule, the Contractor will submit a revised network diagram, the associated compact disk(s), and a list of any activity/event changes including predecessors and successors for any of the following reasons:
   1. Delay in completion of any activity/event or group of activities/events, indicate an extension of the project completion by 20 working days or 10 percent of the remaining project duration, whichever is less. Such delays which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
   2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
   3. The schedule does not represent the actual prosecution and progress of the project.
   4. When there is, or has been, a substantial revision to the activity/event costs of the network diagram regardless of the cause for these revisions.

B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Medical Center, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, must be furnished in writing to the Contracting Officer for approval.

C. Contracting Officer's approval for the revised network diagram and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.

D. The cost of revisions to the network diagram resulting from contract changes will be included in the proposal for changes in work as specified in Article, CHANGES of the Section 00 72 00 GENERAL CONDITIONS, and will be based on the complexity of the revision or

contract change, man hours expended in analyzing the change, and the total cost of the change.

E. The cost of revisions to the network diagram not resulting from contract changes is the responsibility of the Contractor.

1.12 ADJUSTMENT OF CONTRACT COMPLETION

A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the Contracting Officer may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.

B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.

C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under Article, CHANGES, in the Section 00 72 00, GENERAL CONDITIONS. The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.

D. All delays due to non-work activities/events such as RFI’s, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1.1 Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

1.2 For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.

1.3 Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:

A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;

B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;

C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.

1.4 Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.

1.5 Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by the Contracting Officer.

1.6 Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.

1.7 The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR

52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

1.8 Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect- Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.

1.9 Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.

A. Submit samples required by Section 09 06 00, SCHEDULE FOR FINISHES, in quadruplicate. Submit samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.

B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.

1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
4. **Trade Contractor shall ensure that all product submittals do not contain any harmful materials, such as asbestos, lead, mercury, etc.**

All product submittals shall be accompanied with a certified conformance letter from the manufacturer stating such harmful materials do not exist in the submittal product. Each letter shall include company letterhead, date, product and product description, and signature. Any clarifications to this requirement shall be received in writing by the COTR <u>prior</u> to the distribution of product submittal to the Architect/Engineer.

D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.

E. Approved samples will be kept on file by the Contracting Officer at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.

F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.

1. For each drawing required, submit one legible photographic paper or vellum reproducible.
2. Reproducible shall be full size.
3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.

6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.

1.10 Samples shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

van Zelm Engineers
(Architect-Engineer)
10 Talcott Notch Road
(A/E P.O. Address)
Farmington, CT 06032
(City, State and Zip Code)

1.11 At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the Contracting Officer.

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SECTION 01 35 26

GOVERNMENTAL SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)
2. ASSE/SAFE A10.32(2004) Fall Protection
3. ASSE/SAFE A10.34(2001; R 2005) Protection of the Public on or Adjacent to Construction Sites
4. ASSE/SAFE Z359.1(2007) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components
5. ASME INTERNATIONAL (ASME)
6. ASME B30.22(2005) Articulating Boom Cranes
7. ASME B30.3(2004) Construction Tower Cranes
8. ASME B30.5(2004) Mobile and Locomotive Cranes
9. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) – Listed but not limited to the following:
10. NFPA 10(2006; Errata 2006) Standard for Portable Fire Extinguishers
11. NFPA 241(2004) Safeguarding Construction, Alteration, and Demolition Operations
12. NFPA 51B(2003) Fire Prevention During Welding, Cutting, and Other Hot Work
13. NFPA 70(2007) National Electrical Code - 2008 Edition
14. NFPA 70E(2004; AMD 2004) Electrical Safety in the Workplace
15. NFPA 13 Sprinklers
16. NFPA 101 Life Safety
17. NFPA 80 Fire Doors & Protective Openings
18. U.S. ARMY CORPS OF ENGINEERS (USACE)
19. EM 385-1-1(2003) Safety -- Safety and Health Requirements
20. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA) – Listed but not limited to the following:
21. 10 CFR 20 Standards for Protection Against Radiation
22. 29 CFR 1910 Occupational Safety and Health Standards

23. 29 CFR 1910.146 Permit-required Confined Spaces
24. 29 CFR 1915Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
25. 29 CFR 1919 Gear Certification
26. 29 CFR 1926 Safety and Health Regulations for Construction
27. 29 CFR 1926.500 Fall Protection

1.2 SUBMITTALS

A. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1. Government acceptance is required for submittals with a "G, A" designation.
2. SD-01 Preconstruction Submittals
3. Accident Prevention Plan (APP); G, A
4. Activity Hazard Analysis (AHA); G, A
5. Crane Critical Lift Plan; G, A
6. Proof of qualification for Crane Operators; G, A
7. SD-06 Test Reports
8. Reports
9. Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Reports."
10. Accident Reports
11. Monthly Exposure Reports
12. Crane Reports
13. Regulatory Citations and Violations
14. Gas Protection
15. SD-07 Certificates
16. Confined Space Entry Permit
17. Hot work permit
18. License Certificates
19. Contractor Safety Self-Evaluation Checklist; G, A
20. Certificate of Compliance (Crane)
21. Submit one copy of each permit/certificate attached to each Daily Quality Control Report.

1.3 DEFINITIONS

A. Competent Person for Fall Protection. A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.

B. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

C. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

D. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers and crane walkers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).

E. Qualified Person for Fall Protection. A person with a recognized degree or professional certificate, and with extensive knowledge, training and experience in the field of fall protection; who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.

F. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

1. Death, regardless of the time between the injury and death, or the length of the illness;
2. Days away from work (any time lost after day of injury/illness onset);
3. Restricted work;
4. Transfer to another job;
5. Medical treatment beyond first aid;
6. Loss of consciousness; or
7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

G. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

H. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and/or collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

1.4 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

A. Contracting Officer will provide a "Contractor Safety Self-Evaluation checklist" to the Contractor at the pre-construction conference. The checklist will be completed monthly by the Contractor and submitted with each request for payment voucher. An acceptable score of 90 or greater is required. Failure to submit the completed safety self-evaluation checklist or achieve a score of at least 90, will result in a retention of up to 10 percent of the voucher.

1.5 REGULATORY REQUIREMENTS

A. In addition to the detailed requirements included in the provisions of this contract, comply with USACE EM 385-1-1, and the following federal, state, and local, laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

1.6 SITE QUALIFICATIONS, DUTIES AND MEETINGS

A. Personnel Qualifications

B. Site Safety and Health Officer (SSHO)

1. Provide a site Safety and Health Officer (SSHO) at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The Contractor Quality Control (QC) person can be

the SSHO on this project. Meet the following requirements within the SSHO:

2. Level 4:
   a. A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.
   b. 30-hour OSHA construction safety class or equivalent within the last 5 years.
   c. An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following 7 areas of competency: Fire Safety; Scaffolding; Fall protection; Hazardous energy; Health hazard recognition, evaluation and control of chemical, physical and biological agents; Personal protective equipment and clothing to include selection, use and maintenance.
3. Crane Operators
   a. Meet the crane operators requirements in USACE EM 385-1-1, Section 16 and Appendix G. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacitates of 50,000 pounds or greater, designate crane operators as qualified by a source that qualifies crane operators (i.e., union, a government agency, or and organization that tests and qualifies crane operators). Provide proof of current qualification.
4. Personnel Duties
   a. Site Safety and Health Officer (SSHO)
      1) Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily quality control report.
      2) Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.
      3) Maintain applicable safety reference material on the job site.

4) Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
5) Implement and enforce accepted APPS and AHAs.
6) Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. Post a list of unresolved safety and health deficiencies on the safety bulletin board.
7) Ensure sub-contractor compliance with safety and health requirements.

b. Failure to perform the above duties will result in dismissal of the superintendent and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

5. Meetings

a. Preconstruction Conference

1) Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).
2) Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

3) Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

4) The functions of a Preconstruction conference may take place at the Post-Award Kickoff meeting for Design Build Contracts.

6. Safety Meetings

a. Conduct and document meetings as required by EM 385-1-1. Attach minutes showing contract title, signatures of attendees and a list of topics discussed to the Contractors' daily quality control report.

1.7 ACCIDENT PREVENTION PLAN (APP)

A. Use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Accident Prevention Plan" and show compliance with NASA NPG 8715.3. Specific requirements for some of the APP elements are described below. The APP shall be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer and any designated CSP and/or CIH.

B. Submit the APP to the Contracting Officer 15calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

C. Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

D. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any hazard become evident, stop work in the area, secure the area, and develop a plan to remove the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34,) and the environment.

E. Copies of the accepted plan will be maintained at the resident engineer's office and at the job site.

F. Continuously review and amended the APP, as necessary, throughout the life of the contract. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered.

G. EM 385-1-1 Contents

H. In addition to the requirements outlines in Appendix A of USACE EM 385-1-1, the following is required:

1. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. Specify the duties of each position.

2. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and

biological agents; personal protective equipment and clothing to include selection, use and maintenance.

3. Confined Space Entry Plan. Develop a confined space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)
4. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. Submit 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.C.18. and the following:
   a. For lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.550(g).
5. Fall Protection and Prevention (FP&P) Plan. The plan shall be site specific and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 1.8 m (6 feet). A qualified person for fall protection shall prepare and sign the plan. Include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Revise the fall Protection and Prevention Plan every six months for lengthy projects or different roof area reflecting any changes during the course of construction due to changes in personnel, equipment, systems or

work habits. Keep and maintain the accepted Fall Protection and Prevention Plan at the job site for the duration of the project. Include the Fall Protection and Prevention Plan in the Accident Prevention Plan (APP).

6. Occupant Protection Plan. The safety and health aspects of lead-based paint removal, prepared in accordance with Section 02 82 16.00 20 LEAD BASED PAINT HAZARD ABATEMENT and 02 82 33.13 20 REMOVAL AND DISPOSAL OF LEAD CONTAINING PAINT.
7. Lead Compliance Plan. The safety and health aspects of lead work, prepared in accordance with Section 02 83 13.00 20 LEAD IN CONSTRUCTION.
8. Asbestos Hazard Abatement Plan. The safety and health aspects of asbestos work, prepared in accordance with Section 02 82 14.00 10 ASBESTOS ABATEMENT 02 82 16.00 20 ENGINEERING CONTROL OF ASBESTOS CONTAINING MATERIALS.
9. Site Demolition Plan. The safety and health aspects prepared in accordance with Section 02 41 00 DEMOLITION and referenced sources.

1.8 ACTIVITY HAZARD ANALYSIS (AHA)

A. The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

B. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

C. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

1.9 DISPLAY OF SAFETY INFORMATION

A. Within 1 calendar days after commencement of work, erect a safety bulletin board at the job site. Include and maintain information on

safety bulletin board as required by EM 385-1-1, section 01.A.06. Additional items required to be posted include:

1. Confined space entry permit.
2. Hot work permit.

1.10 SITE SAFETY REFERENCE MATERIALS

A. Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

1.11 EMERGENCY MEDICAL TREATMENT

A. Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.12 REPORTS

A. Accident Reports

1. Conduct an accident investigation for recordable injuries and illnesses, and property damage accidents resulting in at least $2,000 in damages, to establish the root cause(s) of the accident, complete the USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 5 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.
2. Conduct an accident investigation for any weight handling equipment accident (including rigging gear accidents) to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer. The Contracting Officer will provide a blank copy of the accident report form.

B. Accident Notification

1. Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than $2,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of

activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

C. Monthly Exposure Reports

1. Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

D. Crane Reports

1. Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix H and as specified herein with Daily Reports of Inspections.

E. Certificate of Compliance

1. Provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). State within the certificate that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance comply with 29 CFR 1926 and USACE EM 385-1-1 section 16 and Appendix H. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. Also certify that all of its crane operators working on the VA activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). Post certifications on the crane.

1.13 HOT WORK

A. Submit and obtain a written permit prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, from the Safety & Fire Specialist. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC

rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit.

B. When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire phone number. ANY FIRE, NO MATTER HOW SMALL, SHAL BE REPORTED TO THE RESPONSIBLE Safety & Fire Specialist IMMEDIATELY.

1.14 RADIATION SAFETY REQUIREMENTS

A. License Certificates for radiation materials and equipment shall be submitted to the Contracting Officer for all specialized material and equipment that could cause fatal harm to construction personnel or to the construction project.

B. Workers shall be protected from radiation exposure in accordance with 10 CFR 20. Standards for Protection Against Radiation

C. Loss of radioactive material shall be reported immediately to the Contracting Officer.

D. Actual exposure of the radiographic film or unshielding the source shall not be initiated until after 5 p.m. on weekdays.

E. In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, no assumptions shall be made as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, a fully instructed employee shall be positioned inside such building or area to prevent exiting while external radiographic operations are in process.

1.15 FACILITY OCCUPANCY CLOSURE

A. Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer.

1.16 GAS PROTECTION

A. Contractor shall have one or more employees properly trained in operation of gas testing equipment and formally qualified as gas inspectors who shall be on duty during times workmen are in confined spaces. Their primary functions shall be to test for gas and operate testing equipment. Unless equipment of constant supervisory type with automatic alarm is employed, gas tests shall be made at least every 2 hours or more often when character of ground or experience indicates gas may be encountered. A gas test shall be made before workmen are permitted to enter the excavation after an idle period exceeding one-half hour.

B. Readings shall be permanently recorded daily, indicating the concentration of gas, point of test, and time of test. Submit copies of the gas test readings to the Contracting Officer at the end of each work day.

C. Special requirements, coordination, and precautions will apply to areas that contain a hazardous atmosphere or, by virtue of their use or physical character, may be oxygen deficient. A check by Government is required prior to entering confined space. Surveillance and monitoring shall be required in these types of work spaces by both Contractor and Government personnel.

1.17 HIGH NOISE LEVEL PROTECTION

A. Operations performed by the Contractor that involve the use of equipment with output of high noise levels (jackhammers, air compressors, and explosive device activated tools) shall be scheduled for after duty working hours during the hours 6pm to 9pm at night. Use of any such equipment shall be approved in writing by the Contracting Officer prior to commencement of work.

1.18 SEVERE STORM PLAN

A. In the event of a severe storm warning, the Contractor must:

1. Secure outside equipment and materials and place materials that could be damaged in protected areas.
2. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
3. Ensure that temporary erosion controls are adequate.

PART 2 - PRODUCTS

2.1 CONFINED SPACE SIGNAGE

A. Provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of 25 mm (one inch) in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from 1.52 m (5 feet).

2.2 FALL PROTECTION ANCHORAGE

A. Leave in place fall protection anchorage, conforming to ASSE/SAFE Z359.1, installed under the supervision of a qualified person in fall protection, for continued customer use and so identified by signage stating the capacity of the anchorage (strength and number of persons who may be tied-off to it at any one time).

PART 3 - EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

A. Comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

1. Hazardous Material Use

   a. Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Material safety data sheets (MSDS) shall be submitted. Allow a minimum of 10 working days for processing of the request for use of a hazardous material.

2. Hazardous Material Exclusions

   a. Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may

consider exceptions to the use of any of the above excluded materials.

3. Unforeseen Hazardous Material

a. The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If additional material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

A. Contractors are required to apply for utility outages at least 30 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, attend a pre-outage coordination meeting with the Contracting Officer and the Installation representative to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

3.3 SAFETY LOCKOUT/TAG-OUT PROCEDURES

A. Contractor shall ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.147.

B. Contracting Officer will, at the Contractor's request, apply lockout/tag-out tags and take other actions that, because of experience and knowledge, are known to be necessary to make the particular equipment safe to work on.

C. No person, regardless of position or authority, shall operate any switch, valve, or equipment that has an official lockout/tag-out tag

attached to it, nor shall such tag be removed except as provided in this section.

D. No person shall work on any equipment that requires a lockout/tag-out tag unless he, his immediate supervisor, project leader, or a subordinate has in his possession the stubs of the required lockout/tag-out tags.

E. When work is to be performed on electrical circuits, only qualified personnel shall perform work on electrical circuits.

F. A supervisor who is required to enter an area protected by a lockout/tag-out tag will be considered a member of the protected group provided he notifies the holder of the tag stub each time he enters and departs from the protected area.

G. Identification markings on building light and power distribution circuits shall not be relied on for established safe work conditions.

H. Before clearance will be given on any equipment other than electrical (generally referred to as mechanical apparatus), the apparatus, valves, or systems shall be secured in a passive condition with the appropriate vents, pins, and locks.

I. Pressurized or vacuum systems shall be vented to relieve differential pressure completely.

J. Vent valves shall be tagged open during the course of the work.

K. Where dangerous gas or fluid systems are involved, or in areas where the environment may be oxygen deficient, system or areas shall be purged, ventilated, or otherwise made safe prior to entry.

1. Tag Placement

a. Lockout/tag-out tags shall be completed in accordance with the regulations printed on the back thereof and attached to any device which, if operated, could cause an unsafe condition to exist.

L. If more than one group is to work on any circuit or equipment, the employee in charge of each group shall have a separate set of lockout/tag-out tags completed and properly attached.

M. When it is required that certain equipment be tagged, the Government will review the characteristics of the various systems involved that affect the safety of the operations and the work to be done; take the necessary actions, including voltage and pressure checks, grounding, and venting, to make the system and equipment safe to work on; and

apply such lockout/tagout tags to those switches, valves, vents, or other mechanical devices needed to preserve the safety provided. This operation is referred to as "Providing Safety Clearance."

1. Tag Removal
   a. When any individual or group has completed its part of the work and is clear of the circuits or equipment, the supervisor, project leader, or individual for whom the equipment was tagged shall turn in his signed lockout/tag-out tag stub to the Contracting Officer. That group's or individual's lockout/tag-out tags on equipment may then be removed on authorization by the Contracting Officer.

3.4 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

A. Establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures.

1. Training
   a. Institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, provide training for each employee who might be exposed to fall hazards. Provide training by a competent person for fall protection in accordance with USACE EM 385-1-1, section 21.A.16.
2. Fall Protection Equipment and Systems
   a. Enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, section 21. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, paragraphs 05.H. and 05.I. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts

if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M, USACE EM 385-1-1 and ASSE/SAFE A10.32.

3. Personal Fall Arrest Equipment

a. Personal fall arrest equipment, systems, subsystems, and components shall meet ASSE/SAFE Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabineers shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 1.8 m (6 feet). The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

4. Fall Protection for Roofing Work

a. Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

1) Low Sloped Roofs:

a) (1) For work within 1.8 m (6 feet) of an edge, on low-slope roofs, Protect personnel from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.

b) (2) For work greater than 1.8 m (6 feet) from an edge, erect and install warning lines in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

b. Steep-Sloped Roofs: Work on steep-sloped roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

5. Existing Anchorage

a. Certified (or re-certified) by a qualified person for fall protection existing anchorages, to be used for attachment of personal fall arrest equipment in accordance with ASSE/SAFE Z359.1. Exiting horizontal lifeline anchorages must be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

6. Horizontal Lifelines

a. Design, install, certify and use under the supervision of a qualified person horizontal lifelines for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

7. Guardrails and Safety Nets

a. Design, install and use guardrails and safety nets in accordance with EM 385-1-1 and 29 CFR 1926 Subpart M.

8. Rescue and Evacuation Procedures

a. When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP).

3.5 SCAFFOLDING

A. Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access scaffold platforms greater than 6 m (20 feet) maximum in height by use of a scaffold stair system. Do not use vertical ladders commonly provided by scaffold system

manufacturers for accessing scaffold platforms greater than 6 m (20 feet) maximum in height. The use of an adequate gate is required. Ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Give special care to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Place work platforms on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.6 EQUIPMENT

A. Material Handling Equipment

1. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.
2. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.
3. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

B. Weight Handling Equipment

1. Equip cranes and derricks as specified in EM 385-1-1, section 16.
2. Notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Prior to cranes entering federal activities, a Crane Access Permit must be obtained from the Contracting Officer. A copy of the permitting process will be

provided at the Preconstruction Conference. Contractor's operator shall remain with the crane during the spot check.

3. Comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.
4. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.
5. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.
6. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.
7. Do not crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane.
8. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.
9. All employees must keep clear of loads about to be lifted and of suspended loads.
10. Use cribbing when performing lifts on outriggers.
11. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
12. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.
13. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

14. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.
15. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).
16. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. Prior to conducting lifting operations set a maximum wind speed at which a crane can be safely operated based on the equipment being used, the load being lifted, experience of operators and riggers, and hazards on the work site. This maximum wind speed determination shall be included as part of the activity hazard analysis plan for that operation.

C. Equipment and Mechanized Equipment

1. Proof of qualifications for operator shall be kept on the project site for review.
2. Manufacture specifications or owner's manual for the equipment shall be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorperate such additional safety precautions or requirements into the AHAs.
3. Submit a Machinery & Mechanized Equipment Certification Form for acceptance by the Contracting Officer prior to being placed into use. A copy of the certification form will be provided during the Pre-construction Conference.

3.7 USE OF EXPLOSIVES

A. Explosives shall not be used or brought to the project site.

3.8 EXCAVATIONS

A. Perform soil classification by a competent person in accordance with 29 CFR 1926.

1. Utility Locations

a. Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

2. Utility Location Verification
   a. The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 0.061 m (2 feet) of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility expose the utility by hand digging every 30.5 m (100 feet) if parallel within 1.5 m (5 feet) of the excavation.
3. Shoring Systems
   a. Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on-site for review. Job-made shoring or shielding must have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.
4. Trenching Machinery
   a. Operate trenching machines with digging chain drives only when the spotters/laborers are in plain view of the operator. Provide operator and spotters/laborers training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Keep documentation of the training on file at the project site.

3.9 UTILITIES WITHIN CONCRETE SLABS

A. Utilities located within concrete slabs or pier structures, bridges, and the like, are extremely difficult to identify due to the reinforcing steel used in the construction of these structures. Whenever contract work involves concrete chipping, saw cutting, or core drilling, the existing utility location must be coordinated with station utility departments in addition to a private locating service. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

3.10 ELECTRICAL

A. Conduct of Electrical Work

1. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the mandatory method. When working in energized substations, only qualified electrical workers will be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

B. Portable Extension Cords

1. Size portable extension cords in accordance with manufacturer ratings for the tool to be powered and protected from damage. Immediately remove from service all damaged extension cords. Portable extension cords shall meet the requirements of NFPA 70.

3.11 WORK IN CONFINED SPACES

A. Comply with the requirements in Section 06.I of USACE EM 385-1-1, OSHA 29 CFR 1910.146 and OSHA 29 CFR 1926.21(b)(6). Any potential for a hazard in the confined space requires a permit system to be used.

1. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 06.I.06 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.
2. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.
3. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

----- END -----

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to – GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L’Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.

B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
811 Vermont Avenue, NW - Room 462
Washington, DC 20420
Telephone Numbers: (202) 461-8217 or (202) 461-8292
Between 9:00 AM - 3:00 PM

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA	Aluminum Association Inc. http://www.aluminum.org
AABC	Associated Air Balance Council http://www.aabchq.com
AAMA	American Architectural Manufacturer's Association http://www.aamanet.org
AAN	American Nursery and Landscape Association http://www.anla.org
AASHTO	American Association of State Highway and Transportation Officials http://www.aashto.org
AATCC	American Association of Textile Chemists and Colorists http://www.aatcc.org
ACGIH	American Conference of Governmental Industrial Hygienists http://www.acgih.org
ACI	American Concrete Institute http://www.aci-int.net
ACPA	American Concrete Pipe Association http://www.concrete-pipe.org
ACPPA	American Concrete Pressure Pipe Association http://www.acppa.org
ADC	Air Diffusion Council http://flexibleduct.org
AGA	American Gas Association http://www.aga.org
AGC	Associated General Contractors of America http://www.agc.org
AGMA	American Gear Manufacturers Association, Inc. http://www.agma.org
AHAM	Association of Home Appliance Manufacturers http://www.aham.org
AISC	American Institute of Steel Construction http://www.aisc.org
AISI	American Iron and Steel Institute http://www.steel.org
AITC	American Institute of Timber Construction http://www.aitc-glulam.org
AMCA	Air Movement and Control Association, Inc. http://www.amca.org

ANLA	American Nursery & Landscape Association http://www.anla.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
APA	The Engineered Wood Association http://www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute http://www.ari.org
ASAE	American Society of Agricultural Engineers http://www.asae.org
ASCE	American Society of Civil Engineers http://www.asce.org
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org
ASTM	American Society for Testing and Materials http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org
AWS	American Welding Society http://www.aws.org
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	Brick Institute of America http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CI	The Chlorine Institute, Inc. http://www.chlorineinstitute.org
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org

CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute http://www.chainlinkinfo.org
CPMB	Concrete Plant Manufacturers Bureau http://www.cpmb.org
CRA	California Redwood Association http://www.calredwood.org
CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org
CTI	Cooling Technology Institute http://www.cti.org
DHI	Door and Hardware Institute http://www.dhi.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EEI	Edison Electric Institute http://www.eei.org
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.et1.com
FAA	Federal Aviation Administration http://www.faa.gov
FCC	Federal Communications Commission http://www.fcc.gov
FPS	The Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.cssinfo.com/info/gana.html/
FM	Factory Mutual Insurance http://www.fmglobal.com
GA	Gypsum Association http://www.gypsum.org
GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org

HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org
ICBO	International Conference of Building Officials http://www.icbo.org
ICEA	Insulated Cable Engineers Association Inc. http://www.icea.net
\ICAC	Institute of Clean Air Companies http://www.icac.com
IEEE	Institute of Electrical and Electronics Engineers http://www.ieee.org\
IMSA	International Municipal Signal Association http://www.imsasafety.org
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association http://www.mbma.com
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. http://www.mss-hq.com
NAAMM	National Association of Architectural Metal Manufacturers http://www.naamm.org
NAPHCC	Plumbing-Heating-Cooling Contractors Association http://www.phccweb.org.org
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors http://www.nationboard.org
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association http://www.nema.org
NFPA	National Fire Protection Association http://www.nfpa.org
NHLA	National Hardwood Lumber Association http://www.natlhardwood.org
NIH	National Institute of Health http://www.nih.gov
NIST	National Institute of Standards and Technology http://www.nist.gov

NLMA	Northeastern Lumber Manufacturers Association, Inc. http://www.nelma.org
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879 (301) 670-0604
NSF	National Sanitation Foundation http://www.nsf.org
NWWDA	Window and Door Manufacturers Association http://www.nwwda.org
OSHA	Occupational Safety and Health Administration Department of Labor http://www.osha.gov
PCA	Portland Cement Association http://www.portcement.org
PCI	Precast Prestressed Concrete Institute http://www.pci.org
PPI	The Plastic Pipe Institute http://www.plasticpipe.org
PEI	Porcelain Enamel Institute, Inc. http://www.porcelainenamel.com
PTI	Post-Tensioning Institute http://www.post-tensioning.org
RFCI	The Resilient Floor Covering Institute http://www.rfci.com
RIS	Redwood Inspection Service See - CRA
RMA	Rubber Manufacturers Association, Inc. http://www.rma.org
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Door Institute http://www.steeldoor.org
IGMA	Insulating Glass Manufacturers Alliance http://www.igmaonline.org
SJI	Steel Joist Institute http://www.steeljoist.org

SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc. http://www.smacna.org
SSPC	The Society for Protective Coatings http://www.sspc.org
STI	Steel Tank Institute http://www.steeltank.com
SWI	Steel Window Institute http://www.steelwindows.com
TCA	Tile Council of America, Inc. http://www.tileusa.com
TEMA	Tubular Exchange Manufacturers Association http://www.tema.org
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive; Suite 200 Madison, WI 53719 (608) 833-5900
UBC	The Uniform Building Code See ICBO
UL	Underwriters' Laboratories Incorporated http://www.ul.com
ULC	Underwriters' Laboratories of Canada http://www.ulc.ca
WCLIB	West Coast Lumber Inspection Bureau 6980 SW Varns Road, P.O. Box 23145 Portland, OR 97223 (503) 639-0651
WRCLA	Western Red Cedar Lumber Association P.O. Box 120786 New Brighton, MN 55112 (612) 633-4334
WWPA	Western Wood Products Association http://www.wwpa.org

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SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.

1.2 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

T27-06.....Sieve Analysis of Fine and Coarse Aggregates

T96-02 (R2006).....Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

T99-01 (R2004).....The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2003).....Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-01 (R2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

T191-02(R2006).....Density of Soil In-Place by the Sand-Cone Method

C. American Concrete Institute (ACI):

506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete

D. American Society for Testing and Materials (ASTM):

A325-06.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A370-07.....Definitions for Mechanical Testing of Steel Products

A416/A416M-06.....Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

A490-06.....Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

C31/C31M-06.....Making and Curing Concrete Test Specimens in the Field

C33-03.....Concrete Aggregates

C39/C39M-05.....Compressive Strength of Cylindrical Concrete Specimens
C109/C109M-05.....Compressive Strength of Hydraulic Cement Mortars
C138-07.....Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C140-07.....Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M-05.....Slump of Hydraulic Cement Concrete
C172-07.....Sampling Freshly Mixed Concrete
C173-07.....Air Content of freshly Mixed Concrete by the Volumetric Method
C330-05.....Lightweight Aggregates for Structural Concrete
C567-05.....Density Structural Lightweight Concrete
C780-07.....Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-08.....Sampling and Testing Grout
C1064/C1064M-05.....Freshly Mixed Portland Cement Concrete
C1077-06.....Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314-07.....Compressive Strength of Masonry Prisms
D698-07.....Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143-07.....Piles Under Static Axial Compressive Load
D1188-07.....Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D1556-07.....Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557-07.....Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166-06.....Unconfined Compressive Strength of Cohesive Soil
D2167-94(R2001).....Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216-05.....Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2922-05.....Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D2974-07.....Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-(2002).....Minimum Requirements for Agencies Testing and Inspection Bituminous Paving Materials
D3740-07.....Minimum Requirements for Agencies Engaged in the Testing and Inspecting Road and Paving Material
E94-04.....Radiographic Testing
E164-03.....Ultrasonic Contact Examination of Weldments
E329-07.....Agencies Engaged in Construction Inspection and/or Testing
E543-06.....Agencies Performing Non-Destructive Testing
E605-93(R2006).....Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
E709-(2001).....Guide for Magnetic Particle Examination
E1155-96(R2008).....Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):
D1.1-07.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

A. Accreditation Requirements: Testing Laboratory retained and paid for by Contractor, must be accredited by one or more of the National Voluntary Laboratory Accreditation Program (NVLAP) programs acceptable in the geographic region for the project. Furnish to the Contracting Officer a copy of the Certificate of Accreditation and Scope of Accreditation. For testing laboratories that have not yet obtained accreditation by a NVLAP program, submit an acknowledgement letter from one of the laboratory accreditation authorities indicating that the application for accreditation has been received and the accreditation process has started, and submit to the Contracting Officer for approval, certified statements, signed by an official of the testing laboratory attesting that the proposed laboratory, meets or conforms to the ASTM standards listed below as appropriate to the testing field.
   1. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E329.
   2. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C1077.
   3. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D3666.
   4. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D3740.

5. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A880.
6. Laboratories engaged in non-destructive testing (NDT) shall meet the requirements of ASTM E543.
7. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA.

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Resident Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.

C. Written Reports: Testing laboratory shall submit test reports to Resident Engineer, Contractor, and Local Building Authority within 24 hours after each test is completed unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to Resident Engineer immediately of any irregularity.

E. Test Standards: The Contractor shall include a lump sum allowance of $5000 for furnishing published standards (ASTM, AASHTO, ACI, ANSI, AWS, ASHRAE, UL, etc.) referred to or specifically referenced which are pertinent to any Sections of these specifications. Furnish one set of standards in single copies or bound volumes to the Resident Engineer within 60 days. Photocopies are not acceptable. Billings for the standards furnished shall be at the net cost to Testing Laboratory. A preliminary list of test standards, with the estimated costs, shall be submitted to the Resident Engineer for review before any publications of reference standards are ordered.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

- - - E N D - - -

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL
1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530/F-93/004(1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846)

EPA 833-R-060-04(2000) Developing Your Storm Water Pollution Prevention Plan, a Guide for Construction Sites

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1910.120 Hazardous Waste Operations and Emergency Response

40 CFR 112 Oil Pollution Prevention

40 CFR 122.26 Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)

40 CFR 241Guidelines for Disposal of Solid Waste

40 CFR 243Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste

40 CFR 258 Subtitle D Landfill Requirements

40 CFR 260 Hazardous Waste Management System: General

40 CFR 261 Identification and Listing of Hazardous Waste

40 CFR 262 Standards Applicable to Generators of Hazardous Waste

40 CFR 263 Standards Applicable to Transporters of Hazardous Waste

40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 266 Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities

40 CFR 268 Land Disposal Restrictions

40 CFR 270 EPA Administered Permit Programs: The Hazardous Waste Permit Program

40 CFR 271 Requirements for Authorization of State Hazardous Waste Programs

40 CFR 272 Approved State Hazardous Waste Management Programs

40 CFR 273 Standards For Universal Waste Management

40 CFR 279 Standards for the Management of Used Oil

40 CFR 300 National Oil and Hazardous Substances Pollution Contingency Plan

40 CFR 355 Emergency Planning and Notification

40 CFR 372-SUBPART D Specific Toxic Chemical Listings

40 CFR 761 Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

40 CFR 82 Protection of Stratospheric Ozone

49 CFR 171 General Information, Regulations, and Definitions

49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 173 Shippers - General Requirements for Shipments and Packagings

49 CFR 178 Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.2 Solid Waste

Garbage, refuse, debris, sludge, or other discharged material, including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations. Types of solid waste typically generated at construction sites may include:

a. Green waste: The vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

b. Surplus soil: Existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included.

c. Debris: Non-hazardous solid material generated during the construction, demolition, or renovation of a structure which exceeds 2.5 inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection..

d. Wood: Dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated and/or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included.

e. Scrap metal: Scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

f. Paint cans: Metal cans that are empty of paints, solvents, thinners and adhesives. If permitted by the paint can label, a thin dry film may remain in the can.

g. Recyclables: Materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable. Metal meeting the definition of lead contaminated or lead based paint contaminated may be included as recyclable if sold to a scrap metal company. Paint cans may not be included as recyclable if sold to a scrap metal company.

h. Hazardous Waste: By definition, to be a hazardous waste a material must first meet the definition of a solid waste. Hazardous waste and hazardous debris are special cases of solid waste. They have additional regulatory controls and must be handled separately. They are thus defined separately in this document.

Material not regulated as solid waste are: nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.3 Hazardous Debris

As defined in Solid Waste paragraph, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) per 40 CFR 261; or debris that exhibits a characteristic of hazardous waste per 40 CFR 261.

1.2.4 Chemical Wastes

This includes salts, acids, alkalizes, herbicides, pesticides, and organic chemicals.

1.2.5 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.6 Hazardous Waste

Any discarded material, liquid, solid, or gas, which meets the definition of hazardous material or is designated hazardous waste by the Environmental Protection Agency or State Hazardous Control Authority as defined in 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 271, 40 CFR 272, 40 CFR 273, 40 CFR 279, and 40 CFR 280.

1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that:

a. Is regulated as a hazardous material per 49 CFR 173, or

b. Requires a Material Safety Data Sheet (MSDS) per 29 CFR 1910.120, or

c. During end use, treatment, handling, packaging, storage, transpiration, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D.

Designation of a material by this definition, when separately regulated or controlled by other instructions or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this instruction for "control" purposes. Such material include ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs). Nonetheless, the exposure may occur incident to manufacture, storage, use and demilitarization of these items.

1.2.8 Waste Hazardous Material (WHM)

Any waste material which because of its quantity, concentration, or physical, chemical, or infectious characteristics may pose a substantial hazard to human health or the environment and which has been so designated. Used oil not containing any hazardous waste, as defined above, falls under this definition.

1.2.9 Oily Waste

Those materials which are, or were, mixed with used oil and have become separated from that used oil. Oily wastes also means materials, including

wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, used oil and may be appropriately tested and discarded in a manner which is in compliance with other State and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that:

a. It is not prohibited in other State regulations or local ordinances

b. The amount generated is "de minimus" (a small amount)

c. It is the result of minor leaks or spills resulting from normal process operations

d. All free-flowing oil has been removed to the practical extent possible

Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, a hazardous waste determination must be performed prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.10 Regulated Waste

Those solid waste that have specific additional Federal, state, or local controls for handling, storage, or disposal.

1.2.11 Class I Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act and includes the following chemicals:

chlorofluorocarbon-11 (CFC-11)
chlorofluorocarbon-12 (CFC-12)
chlorofluorocarbon-13 (CFC-13)
chlorofluorocarbon-111 (CFC-111)
chlorofluorocarbon-112 (CFC-112)
chlorofluorocarbon-113 (CFC-113)
chlorofluorocarbon-114 (CFC-114)
chlorofluorocarbon-115 (CFC-115)
chlorofluorocarbon-211 (CFC-211)
chlorofluorocarbon-212 (CFC-212)
chlorofluorocarbon-213 (CFC-213)
chlorofluorocarbon-214 (CFC-214)
chlorofluorocarbon-215 (CFC-215)
chlorofluorocarbon-216 (CFC-216)
chlorofluorocarbon-217 (CFC-217)
chlorofluorocarbon-500 (CFC-500)
chlorofluorocarbon-502 (CFC-502)
chlorofluorocarbon-503 (CFC-503)
halon-1211
halon-1301

halon-2402
carbon tetrachloride
methyl bromide
methyl chloroform

Class II ODS is defined in Section 602(s) of The Clean Air Act and includes the following chemicals:

hydrochlorofluorocarbon-21 (HCFC-21)
hydrochlorofluorocarbon-22 (HCFC-22)
hydrochlorofluorocarbon-31 (HCFC-31)
hydrochlorofluorocarbon-121 (HCFC-121)
hydrochlorofluorocarbon-122 (HCFC-122)
hydrochlorofluorocarbon-123 (HCFC-123)
hydrochlorofluorocarbon-124 (HCFC-124)
hydrochlorofluorocarbon-131 (HCFC-131)
hydrochlorofluorocarbon-132 (HCFC-132)
hydrochlorofluorocarbon-133 (HCFC-133)
hydrochlorofluorocarbon-141 (HCFC-141)
hydrochlorofluorocarbon-142 (HCFC-142)
hydrochlorofluorocarbon-221 (HCFC-221)
hydrochlorofluorocarbon-222 (HCFC-222)
hydrochlorofluorocarbon-223 (HCFC-223)
hydrochlorofluorocarbon-224 (HCFC-224)
hydrochlorofluorocarbon-225 (HCFC-225)
hydrochlorofluorocarbon-226 (HCFC-226)
hydrochlorofluorocarbon-231 (HCFC-231)
hydrochlorofluorocarbon-232 (HCFC-232)
hydrochlorofluorocarbon-233 (HCFC-233)
hydrochlorofluorocarbon-234 (HCFC-234)
hydrochlorofluorocarbon-235 (HCFC-235)
hydrochlorofluorocarbon-241 (HCFC-241)
hydrochlorofluorocarbon-242 (HCFC-242)
hydrochlorofluorocarbon-243 (HCFC-243)
hydrochlorofluorocarbon-244 (HCFC-244)
hydrochlorofluorocarbon-251 (HCFC-251)
hydrochlorofluorocarbon-252 (HCFC-252)
hydrochlorofluorocarbon-253 (HCFC-253)
hydrochlorofluorocarbon-261 (HCFC-261)
hydrochlorofluorocarbon-262 (HCFC-262)
hydrochlorofluorocarbon-271 (HCFC-271)

1.2.11.1 Universal Waste
The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (e.g., thermostats) and lamps (e.g., fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control

approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey; G

Solid Waste Management Plan and Permit; G

Regulatory Notifications; G

Environmental Management Plan; G

Storm Water Pollution Prevention Plan; G

Storm Water Notice of Intent (for NPDES coverage under the general permit for construction activities); G

Dirt and Dust Control Plan

Contractor Hazardous Material Inventory Log; G

SD-06 Test Reports

Laboratory Analysis

Disposal Requirements

Erosion and Sediment Control Inspection Reports

Storm Water Inspection Reports for General Permit

Contractor 40 CFR employee training records

Solid Waste Management Report; G

SD-11 Closeout Submittals

Some of the records listed below are also required as part of other submittals. For the "Records" submittal, maintain on-site a separate three-ring Environmental Records binder and submit at the completion of the project. Make separate parts to the binder corresponding to each of the applicable sub items listed below.

Storm Water Pollution Prevention Plan compliance notebook; G

Waste Determination Documentation

Disposal Documentation for Hazardous and Regulated Waste

Contractor 40 CFR Employee Training Records

Solid Waste Management Permit

Solid Waste Management Report

Contractor Hazardous Material Inventory Log; G

Hazardous Waste/Debris Management

Regulatory Notifications

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

The Contractor may be required to promptly conduct tests and procedures for the purpose of assessing whether construction operations are in compliance with Applicable Environmental Laws. Analytical work shall be done by qualified laboratories; and where required by law, the laboratories shall be certified.

1.4.1 Environmental Compliance Assessment Training and Tracking System (ECATTS)

1.4.2 Conformance with the Environmental Management System

The Contractor shall perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). The Contractor shall perform work in a manner that conforms to objectives and targets, environmental programs and operational controls identified by the EMS. The Contractor will provide monitoring and measurement information as necessary to address environmental performance relative to environmental, engery, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, the Contractor shall take corrective and/or preventative actions. In addition, the Contractor shall ensure that its employees are aware of their roles and responsibilities under the EMS and how these EMS roles and responsibilities affect work performed under the contract.

The Contractor is responsible for ensuring that their employees receive applicable environmental and occupational health and safety training, and keep up to date on regulatory required specific training for the type of work to be conducted onsite. All on-site Contractor personnel, and their subcontractor personnel, performing tasks that have the potential to cause a significant environmental impact shall be competent on the basis of appropriate education, training or experience. Upon contract award, the Contracting Officer's Representative will notify the installation's EMS coordinator to arrange EMS training. Refer to Section 01 57 19.01 20,

Supplemental Temporary Environmental Controls for additional site specific EMS requirements related to construction. The installation's EMS coordinator shall identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. The Contractor shall provide training documentation to the Contracting Officer. The EMS coordinator shall retain associated records.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Survey

Perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record.

1.5.2 Regulatory Notifications

The Contractor is responsible for all regulatory notification requirements in accordance with Federal, State and local regulations. In cases where the VA must also provide public notification (such as storm water permitting), the Contractor must coordinate with the Contracting Officer. The Contractor shall submit copies of all regulatory notifications to the Contracting Officer prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all inclusive): demolition, renovation, NPDES defined site work, remediation of controlled substances (asbestos, hazardous waste, lead paint).

1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the activity; types and quantities of wastes/wastewater that may be generated during the contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and activity environmental staff to discuss the proposed Environmental Management Plan. Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, required permits, permit requirements, and other measures to be taken.

1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager will be directly responsible for coordinating contractor compliance with Federal, State, local, and station requirements. The Environmental Manager will ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the Environmental Management Plan; ensure that all environmental permits are obtained, maintained, and closed out; ensure compliance with Storm Water Program Management requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however the

person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure all Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out.

1.5.5 Contractor 40 CFR Employee Training Records

Prepare and maintain employee training records throughout the term of the contract meeting applicable 40 CFR requirements. The Contractor will ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with Federal, State and local regulatory requirements for RCRA Large Quantity Generator. The Contractor will provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility. Submit these training records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 ENVIRONMENTAL MANAGEMENT PLAN

Prior to initiating any work on site, the Contractor will meet with the Contracting Officer to discuss the proposed Environmental Protection Plan and develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken. The Contractor's Environmental Plan shall incorporate construction related objectives and targets from the installation's Environmental Management System. The Environmental Management Plan will be submitted in the following format and shall include the elements specified below.

a. Description of the Environmental Management Plan

(1) General overview and purpose

(a). A brief description of each specific plan required by environmental permit or elsewhere in this contract.

(b). The duties and level of authority assigned to the person(s) on the job site that oversee environmental compliance.

(c). A copy of any standard or project specific operating procedures that will be used to effectively manage and protect the environment on the project site.

(d). Communication and training procedures that will be used to convey environmental management requirements to contractor employees and subcontractors.

(e). Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

(2) General site information

(3) A letter signed by an officer of the firm appointing the Environmental Manager and stating that he/she is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

a. Management of Natural Resources

(1) Land resources

(2) Tree protection

(3) Replacement of damaged landscape features

(4) Temporary construction

(5) Stream crossings

(6) Fish and wildlife resources

(7) Wetland areas

c. Protection of Historical and Archaeological Resources

(1) Objectives

(2) Methods

d. Storm Water Management and Control

(1) Ground cover

(2) Erodible soils

(3) Temporary measures

(a) Mechanical retardation and control of runoff

(b) Vegetation and mulch

(4) Effective selection, implementation and maintenance of Best Management Practices (BMPs).

a. Protection of the Environment from Waste Derived from Contractor Operations

(1) Control and disposal of solid and sanitary waste. If Section 01 74 19.05 20 is included in the contract, submit the plan required by that section as part of the Environmental Management Plan.

(2) Control and disposal of hazardous waste (Hazardous Waste Management Section)

This item will consist of the management procedures for all hazardous waste to be generated. The elements of those procedures will coincide with the Activity Hazardous Waste Management Plan. A copy of the Activity Hazardous Waste Management Plan will be provided by the Contracting Officer. As a minimum, include the following:

(a) Procedures to be employed to ensure a written waste determination is made for appropriate wastes which are to be generated;

(b) Sampling/analysis plan;

(c) Methods of hazardous waste accumulation/storage (i.e., in tanks and/or containers);

(d) Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted);

(e) Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268);

(f) Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and the like;

(g) Used oil management procedures in accordance with 40 CFR 279;

(h) Pollution prevention\hazardous waste minimization procedures;

(i) Plans for the disposal of hazardous waste by permitted facilities;

(j) Procedures to be employed to ensure all required employee training records are maintained.

f. Prevention of Releases to the Environment

(1) Procedures to prevent releases to the environment

(2) Notifications in the event of a release to the environment

g. Regulatory Notification and Permits

(1) List what notifications and permit applications must be made. Demonstrate that those permits have been obtained by including copies of all applicable, environmental permits..

3.1.1 Environmental Protection Plan Review

Within thirty days after the Contract award date, submit the proposed Environmental Management Plan for further discussion, review, and approval. Commencement of work will not begin until the environmental management plan has been approved.

3.1.2 Licenses and Permits

No permits will be obtained by the Contracting Officer.

Where required by the State regulatory authority, the inspections and certifications will be provided through the services of a Professional Engineer (PE), registered in the State where the work is being performed. Where a PE is not required, the individual must be otherwise qualified by other current State licensure, specific training and prior experience (minimum 5 years). As a part of the quality control plan, which is required to be submitted for approval by the quality control section, provide a sub item containing the name, appropriate professional registration or license number, address, and telephone number of the professionals or other qualified persons who will be performing the inspections and certifications for each permit.

3.1.3 Storm water Drainage and Construction Dewatering

There will be no discharge of excavation ground water to the sanitary sewer, storm drains, or to the river without prior specific authorization of the Environmental Division in writing. Discharge of hazardous substances will not be permitted under any circumstances.

Construction site runoff will be prevented from entering any storm drain or the river directly by the use of straw bales or other method suitable to the Environmental Division. Contractor will provide erosion protection of the surrounding soils.

Construction Dewatering shall not be discharged to the sanitary sewer. If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Authorization for any contaminated groundwater

release shall be obtained in advance from the base Environmental Officer. Discharge of hazardous substances will not be permitted under any circumstances.

3.2 SOLID WASTE MANAGEMENT PLAN and PERMIT

Provide to the contracting officer written notification of the quantity of solid waste/debris that is anticipated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance or as applicable, submit one copy of a State and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

3.2.1 Solid Waste Management Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

The Contractor will include copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, the Contractor may submit a statement indicating the disposal location for the solid waste which is signed by an officer of the Contractor firm authorized to legally obligate or bind the firm. The sales documentation or Contractor certification will include the receiver's tax identification number and business, EPA or State registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained by the Contractor for his own use, the Contractor will submit on the solid waste disposal report the information previously described in this paragraph. Prices paid or received will not be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged. Remove all solid waste (including non-hazardous debris) from Government property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage spent hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, as per environmental law.

3.2.2.1 Dumpsters

Equip dumpsters with a secure cover and paint the standard base color. Keep cover closed at all times, except when being loaded with trash and debris. Locate dumpsters behind the construction fence or out of the public view.

Empty site dumpsters at least once a week. or as needed to keep the site free of debris and trash. If necessary, provide 55 gallon trash containers painted the darker base color to collect debris in the construction site area. Locate the trash containers behind the construction fence or out of the public view. Empty trash containers at least once a day. For large demolitions, large dumpsters without lids are acceptable but should not have debris higher than the sides before emptying.

3.3 WASTE DETERMINATION DOCUMENTATION

Complete a Waste Determination form (provided at the pre-construction conference) for all contractor derived wastes to be generated. Base the waste determination upon either a constituent listing from the manufacturer used in conjunction with consideration of the process by which the waste was generated, EPA approved analytical data, or laboratory analysis (Material Safety Data Sheets (MSDS) by themselves are not adequate). Attach all support documentation to the Waste Determination form. As a minimum, a Waste Determination form must be provided for the following wastes (this listing is not all inclusive): oil and latex based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and all containers of the original materials.

3.4 CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG

Submit the "Contractor Hazardous Material Inventory Log"(found at: http://www.wbdg.org/ccb/NAVGRAPH/graphtoc_log.pdf), which provides information required by (EPCRA Sections 312 and 313) along with corresponding Material Safety Data Sheets (MSDS) to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Documentation for any spills/releases, environmental reports or off-site transfers may be requested by the Contracting Officer.

3.4.1 Disposal Documentation for Hazardous and Regulated Waste

Manifest, pack, ship and dispose of hazardous or toxic waste and universal waste that is generated as a result of construction in accordance with the generating facilities generator status under the Recourse Conservation and Recovery Act. Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or State permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifest must be reviewed, signed, and approved by the VA before the Contractor may ship waste. To obtain specific disposal instructions the Contractor must coordinate with the GEMS office. The GEMS coordinator is in B15 at 203-932-5711 x2767.

3.5 POLLUTION PREVENTION/HAZARDOUS WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of hazardous waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the Environmental Management Plan. Consult with the activity Environmental Office for

suggestions and to obtain a copy of the installation's pollution prevention/hazardous waste minimization plan for reference material when preparing this part of the plan. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the types of the hazardous materials expected to be used in the construction when requesting information.

3.6 WHM/HW MATERIALS PROHIBITION

No waste hazardous material or hazardous waste shall be disposed of on government property. No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract. The government is not responsible for disposal of Contractor's waste material brought on the job site and not required in the performance of this contract. The intent of this provision is to dispose of that waste identified as waste hazardous material/hazardous waste as defined herein that was generated as part of this contract and existed within the boundary of the Contract limits and not brought in from offsite by the Contractor. Incidental materials used to support the contract including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive. The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or to the river or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

3.7 HAZARDOUS MATERIAL MANAGEMENT

No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract.

Include hazardous material control procedures in the Safety Plan. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Submit a MSDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on base. Typical materials requiring MSDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. At the end of the project, provide the Contracting Officer with the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used. Ensure that hazardous materials are utilized in a manner that will minimize the amount of hazardous waste that is generated. Ensure that all containers of hazardous materials have NFPA labels or their equivalent. Keep copies of the MSDS for hazardous materials on site at all times and provide them to the Contracting Officer at the end of the project. Certify that all hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste per 40 CFR 261.

3.8 PETROLEUM PRODUCTS AND REFULING

Conduct the fueling and lubricating of equipment and motor vehicles in a manner that protects against spills and evaporation. Manage all used oil generated on site in accordance with 40 CFR 279. Determine if any used oil

generated while on-site exhibits a characteristic of hazardous waste. Used oil containing 1000 parts per million of solvents will be considered a hazardous waste and disposed of at Contractor's expense. Used oil mixed with a hazardous waste will also be considered a hazardous waste.

3.8.1 Oily and Hazardous Substances

Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR 112, surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus 10 percent freeboard for precipitation. The berm will be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

3.8.2 Inadvertent Discovery of Petroleum Contaminated Soil or Hazardous Wastes

If petroleum contaminated soil or suspected hazardous waste is found during construction that was not identified in the contract documents, the contractor shall immediately notify the contracting officer. The contractor shall not disturb this material until authorized by the contracting officer.

3.9 RELEASES/SPILLS OF OIL AND HAZARDOUS SUBSTANCES

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated by environmental law. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Base or Activity Fire Department, the activity's Command Duty Officer, and the Contracting Officer. If the contractor's response is inadequate, the Navy may respond. If this should occur, the contractor will be required to reimburse the government for spill response assistance and analysis.

The Contractor is responsible for verbal and written notifications as required by the federal 40 CFR 355, State, local regulations and Navy Instructions. Spill response will be in accordance with 40 CFR 300 and applicable State and local regulations. Contain and clean up these spills without cost to the Government. If Government assistance is requested or required, the Contractor will reimburse the Government for such assistance. Provide copies of the written notification and documentation that a verbal notification was made within 20 days.

Maintain spill cleanup equipment and materials at the work site. Clean up all hazardous and non-hazardous (WHM) waste spills. The Contractor shall reimburse the government for all material, equipment, and clothing generated during any spill cleanup. The Contractor shall reimburse the government for all costs incurred including sample analysis materials, equipment, and labor if the government must initiate its own spill cleanup procedures, for Contractor responsible spills, when:

a. The Contractor has not begun spill cleanup procedure within one hour of spill discovery/occurrence, or

b. If, in the government's judgment, the Contractor's spill cleanup is not adequately abating life threatening situation and/or is a threat to any body of water or environmentally sensitive areas.

3.10 CONTROL AND MANAGEMENT OF HAZARDOUS WASTES

3.10.1 Facility Hazardous Waste Generator Status

The VA CT Healthcare System West Haven Campus is designated as a Large Quantity Generator. All work conducted within the boundaries of this activity must meet the regulatory requirements of this generator designation. The Contractor will comply with all provisions of Federal, State and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of all construction derived wastes.

3.10.2 Hazardous Waste/Debris Management

Identify all construction activities which will generate hazardous waste/debris. Provide a documented waste determination for all resultant waste streams. Hazardous waste/debris will be identified, labeled, handled, stored, and disposed of in accordance with all Federal, State, and local regulations including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Hazardous waste will also be managed in accordance with the approved Hazardous Waste Management Section of the Environmental Protection Plan. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities will be identified as being generated by the Government.

Prior to removal of any hazardous waste from Government property, all hazardous waste manifests must be signed by activity personnel from the Station Environmental Office. No hazardous waste will be brought onto Government property. Provide to the Contracting Officer a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D. For hazardous wastes spills, verbally notify the Contracting Officer immediately.

3.10.2.1 Regulated Waste Storage/Satellite Accumulation/90 Day Storage Areas

If the work requires the temporary storage/collection of regulated or hazardous wastes, the Contractor will request the establishment of a Regulated Waste Storage Area, a Satellite Accumulation Area, or a 90 Day Storage Area at the point of generation. The Contractor must submit a request in writing to the Contracting Officer providing the following information:

Contract Number _____ Contractor _____

Haz/Waste or
Regulated Waste POC _____ Phone Number _____

Type of Waste _____ Source of Waste _____

Emergency POC _____ Phone Number _____

Location of the Site: _____
(Attach Site Plan to the Request)

Attach a waste determination form. Allow ten working days for processing this request. The designated area where waste is being stored shall be barricaded and a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.10.2.2 Sampling and Analysis of HW

a. Waste Sampling

Sample waste in accordance with EPA 530/F-93/004. Each sampled drum or container will be clearly marked with the Contractor's identification number and cross referenced to the chemical analysis performed.

b. Laboratory Analysis

Follow the analytical procedure and methods in accordance with the 40 CFR 261. The Contractor will provide all analytical results and reports performed to the Contracting Officer

c. Analysis Type

Identify waste hazardous material/hazardous waste by analyzing for the following properties as a minimum: ignitability, corrosiveness, total chlorides, BTU value, PCBs, TCLP for heavy metals, and cyanide.

3.10.2.3 Asbestos Certification

Items, components, or materials disturbed by or included in work under this contract do involve asbestos. Other materials in the general area around where work will be performed may contain asbestos. All thermal insulation, in all work areas, should be considered to be asbestos unless positively identified either by previous testing reports, by conspicuous tags or previous laboratory analysis certifying them as asbestos free.

Inadvertent discovery of non-disclosed asbestos that will result in an abatement action requires a change in scope before proceeding. Upon discovery of asbestos containing material not identified in the contract documents, the Contractor shall immediately stop all work that would generate further damage to the material, evacuate the asbestos exposed area, and notify the Contracting Officer for resolution of the situation prior to resuming normal work activities in the affected area. The Contractor will not remove or perform work on any asbestos containing materials without the

prior approval of the Contracting Officer. The Contractor will not engage in any activity, which would remove or damage such materials or cause the generation of fibers from such materials.

Asbestos containing waste shall be managed and disposed of in accordance with applicable environmental law. Asbestos containing waste shall be manifested and the manifest provided to the Contracting Officer.

3.10.2.4 Hazardous Waste Disposal

No hazardous, toxic, or universal waste shall be disposed or hazardous material abandoned on government property. And unless otherwise other wise noted in this contract, the government is not responsible for disposal of Contractor generated waste material. The disposal of incidental materials used to accomplish the work including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive.

The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or water way or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

Control of stored waste, packaging, sampling, analysis, and disposal will be determined by the details in the contract. The requirements for jobs in the following paragraphs will be used as the guidelines for disposal of any hazardous waste generated.

a. Responsibilities for Contractor's Disposal

Contractor responsibilities include any generation of WHM/HW requiring Contractor disposal of solid waste or liquid.

(1) The Contractor agrees to provide all service necessary for the final treatment/disposal of the hazardous material/waste in accordance with all local, State and Federal laws and regulations, and the terms and conditions of the contract within sixty (60) days after the materials have been generated. These services will include all necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal, and/or transportation, including manifesting or completing waste profile sheets, equipment, and the compilation of all documentation is required).

(2) Contain all waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 272, 40 CFR 273, 40 CFR 279, 40 CFR 280, and 40 CFR 761.

(3) Obtaining a representative sample of the material generated for each job done to provide waste stream determination.

(4) Analyzing for each sample taken and providing analytical results to the Contracting Officer. Provide two copies of the results.

(5) Determine the DOT proper shipping names for all waste (each container requiring disposal) and will demonstrate how this determination is developed and supported by the sampling and analysis requirements contained herein to the Contracting Officer.

Contractor Disposal Turn-In Requirements

For any waste hazardous materials or hazardous waste generated which requires the Contractor to dispose of, the following conditions must be complied with in order to be acceptable for disposal:

(1) Drums compatible with waste contents and drums meet DOT requirements for 49 CFR 173 for transportation of materials.

(2) Drums banded to wooden pallets. No more than three (3) 55 gallon drums to a pallet, or two (2) 85 gallon over packs.

(3) Band using 1-1/4 inch minimum band on upper third of drum.

(4) Recovery materials label (provided by Code 106.321) located in middle of drum, filled out to indicate actual volume of material, name of material manufacturer, other vendor information as available.

(5) Always have three (3) to five (5) inches of empty space above volume of material. This space is called 'outage'.

3.10.3 Class I [and II] ODS Prohibition

Class I and II ODS as defined and identified herein will not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition will be considered to prevail over any other provision, specification, drawing, or referenced documents. Regulations related to the protection of stratosphere ozone may be found in 40 CFR 82.

Heating and air conditioning technicians must be certified through an EPA-approved program. Copies of certifications shall be maintained at the employees' place of business and be carried as a wallet card by the technician, as provided by environmental law. Accidental venting of a refrigerant is a release and shall be reported to the Contracting Officer.

3.10.3.1 Universal Waste/e-Waste Management

Universal waste including but not limited to some mercury containing building products such florescent lamps, mercury vapor lamps, high pressure sodium lamps, CRTs, batteries, aerosol paint containers, electrical equipment containing PCBs, and consumed electronic devices, shall be managed in accordance with applicable environmental law and installation instructions.

3.11 DUST CONTROL

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other

areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning non-particulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

3.11.1 Dirt and Dust Control Plan

Submit truck and material haul routes along with a plan for controlling dirt, debris, and dust on base roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

3.12 ABRASIVE BLASTING

3.12.1 Blasting Operations

The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive, agent, paint chips, and other debris. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.12.2 Disposal Requirements

Submit analytical results of the debris generated from abrasive blasting operations per paragraph entitled Laboratory Analysis of this section. Hazardous waste generated from blasting operations will be managed in accordance with paragraph entitled "Hazardous Waste\Debris Management" of this section and with the approved HWMP.

3.13 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted.

3.14 MERCURY MATERIALS

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed. Immediately report to the Environmental Office and the Project Engineer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Cleanup of a mercury spill shall not be recycled and shall be managed as a hazardous waste for disposal.

----- END -----

SECTION 01 58 16
TEMPORARY INTERIOR SIGNAGE

PART 1 GENERAL

DESCRIPTION

This section specifies temporary interior signs.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNS

A. Fabricate from 50 Kg (110 pound) mat finish white paper.

B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.

C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.

D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.

E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.

B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.

C. Identify room with numbers as designated on floor plans.

3.2 LOCATION

A. Install on doors that have room, corridor, and space numbers shown.

B. Doors that do not require signs are as follows:

1. Corridor barrier doors (cross-corridor) in corridor with same number.
2. Folding doors or partitions.
3. Toilet or bathroom doors within and between rooms.
4. Communicating doors in partitions between rooms with corridor entrance doors.
5. Closet doors within rooms.

C. Replace missing, damaged, or illegible signs.

- - - E N D - - -

SECTION 01 62 35
RECYCLED / RECOVERED MATERIALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2 OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. EPA designated products specified in this contract comply with the stated policy and with the EPA guidelines. The Contractor shall make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

1.3 EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered materials unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

1.4 EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

1.5 EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be used by

the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

1.1 DESCRIPTION

A. This specification covers the requirements for management of non-hazardous building construction and demolition waste.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.

D. Reserved items which are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.

E. Asbestos Removal: Section 02 82 14, Asbestos Hazard Control Activities, and Section 02 82 16, Engineering Control of Asbestos Containing Materials.

F. Lead Paint: Section 02 83 13, LEAD In Construction.

1.3 GOVERNMENT POLICY

A. Contractor shall practice efficient waste management when sizing, cutting and installing building construction products.

B. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators and facilitate their recycling.

C. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling and any revenues or savings obtained from salvage or recycling shall accrue to the Contractor.

D. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by federal, state and local regulations.

1.4 PLAN

A. Conduct a site assessment to estimate the types of materials that will be generated by demolition at the site. The Whole Building Design Guide website (http://www.wbdg.org) has a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects

B. Develop and implement procedures to reuse and recycle materials to the greatest extent feasible based upon the contract, the construction and demolition debris management plan, the estimated quantities of materials, and the availability of recycling facilities.

C. Prepare and submit to the Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Contractor and project identification information;
2. Procedures to be used for debris management;
3. A listing of the materials to be reused, recycled, or taken to the landfill.
4. The names and locations of reuse and recycling facilities or sites.

1.5 COLLECTION

A. Provide necessary containers, bins and storage areas to facilitate effective waste management.

B. Clearly identify so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

1.6 DISPOSAL

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state law.

B. Building or demolition materials with no practical use or that cannot be recycled shall be disposed of at a landfill or incinerator.

1.7 REPORT

A. With each application for progress payment, the contractor shall submit a summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

- - - E N D - - -

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 1971(2005) Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37(2000; R 2005) Industrial and Institutional Cleaners

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials

Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

Warranty Management Plan

Two sets of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

Warranty Tags

Two record copies of the warranty tags showing the layout and design.

Final Cleaning

Two copies of the listing of completed final clean-up items.

Spare Parts Data

Two copies of list that indicates manufacturer's name, part number, nomenclature, and stock level recommended for maintenance and repair.

List those items that may be standard to the normal maintenance of the system.

SD-08 Manufacturer's Instructions

Preventative Maintenance and Condition Monitoring (Predictive Testing) and Inspection schedules with instructions that state when systems should be retested.

Define within the schedule the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements. On each test feature; e.g., gpm, rpm, psi, provide a signoff blank for the Contractor and Project Engineer. Within a remarks column of the testing validation procedure include references to operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventative maintenance, condition monitoring (predictive testing) and inspection, adjustment, lubrication and cleaning necessary to prevent failure.

Posted Instructions

SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with paragraph entitled, "Operation and Maintenance," of this section.

SD-11 Closeout Submittals

Record Drawings

Drawings showing final as-built conditions of the project. The final CADD record drawings must consist of one set of electronic CADD drawing files in the specified format, one set of mylar drawings, 2 sets of blue-line prints of the mylars, and one set of the approved working Record drawings. The manually prepared drawings must consist of 1 set of completed final as-built original transparency drawings, 2 sets of blue-line prints of the transparencies, and the approved marked working as-built prints.

Form DD1354; G

Checklist for Form DD1354; G

1.3 PROJECT RECORD DOCUMENTS

1.2.1 Record Drawings

This paragraph covers record drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showing as-built conditions.

1.3.1.1 Government Furnished Materials

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference for projects requiring CADD file record drawings.

1.3.1.2 Working Record and Final Record Drawings

Revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Kept these working as-built marked drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Prepare final record (as-built) drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final record (as-built) drawings will be jointly reviewed for accuracy and completeness by the Project Engineer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final record drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the record drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. Show on the working and final record drawings, but not limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show

by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

d. Changes or modifications which result from the final inspection.

e. Where contract drawings or specifications present options, show only the option selected for construction on the final as-built prints.

f. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

g. Systems designed or enhanced by the Contractor, such as HVAC controls, security, elevator, fire alarm, fire sprinkler systems.

h. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications) and compliance with the following procedures.

   (1) Follow directions in the modification for posting descriptive changes.

   (2) Place a Modification Delta at the location of each deletion.

   (3) For new details or sections which are added to a drawing, place a Modification Circle by the detail or section title.

(4) For minor changes, place a Modification Circle by the area changed on the drawing (each location).

(5) For major changes to a drawing, place a Modification Delta by the title of the affected plan, section, or detail at each location.

(6) For changes to schedules or drawings, place a Modification Delta either by the schedule heading or by the change in the schedule.

(7) The Modification Delta size shall be 1/2 inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.3.1.3 Drawing Preparation

Modify the record drawings as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints must be neat, legible and accurate. These drawings are part of the permanent records of this project and must be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor must be satisfactorily replaced by the Contractor at no expense to the Government.

1.3.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only employ personnel proficient in the preparation of CADD drawings to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CADD files. The Contractor will be furnished "as-designed" drawings in AutoCad Release 2004 format compatible with a Windows XP operating system. The

electronic files will be supplied on compact disc, read-only memory (CD-ROM). Provide all program files and hardware necessary to prepare final record drawings. The Contracting Officer will review final record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

a. Provide CADD "base" colors of red, green, and blue. Color code for changes as follows:
   (1) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.
   (2) Additions (Green) - Added items, lettering in notes and leaders.
   (3) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.

b. Rename the Contract Drawing files in a manner related to the contract number (i.e., 689-374-A2.01 as-built.DWG) as instructed in the Pre-Construction conference. Use only those renamed files for the Marked-up changes. All changes shall be made on the layer/level as the original item.

c. When final revisions have been completed, show the wording "RECORD DRAWINGS / AS-BUILT CONDITIONS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Mark all other contract drawings either "Record" drawing denoting no revisions on the sheet or "Revised Record" denoting one or more revisions. Date original contract drawings in the revision block.

d. Within 20 days for contracts $5 million and above after Government approval of all of the working record drawings for a phase of work, prepare the final CADD record drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days for contracts $5 million and above revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days for contracts $5 million and above of substantial completion of all phases of work, submit the final record drawing package

for the entire project. Submit one set of electronic files on compact disc, read-only memory (CD-ROM), one set of mylars, two sets of blue-line prints and one set of the approved working record drawings. They must be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this are the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record drawing files and marked prints as specified will be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made to the Contractor.

1.3.1.5 Payment

No separate payment will be made for record drawings required under this contract, and all costs accrued in connection with such drawings are considered a subsidiary obligation of the Contractor.

1.3.2 As-Built Record of Equipment and Materials

Furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Submit Two sets of final record of equipment and materials 10 days after final inspection. Key the designations to the related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

The following form shall be filled out for all new equipment, air handlers, fans, compressors, electric panels, transformers, etc.

NEW EQUIPMENT CHECK-IN SHEET

Equipment Nomenclature:_____ PMI#:_____

Manufacture:_____

Model:_____ Serial #:_____

Service:_____ CMR:_____

Location:_____ Bldg.:_____ Wing:_____ Room:_____

Vendor:_____

Address:_____

Phone:_____(_____)_____-_____ PO#:_____ Acq. Value:$_____

Acq. Date:__/____/____Warranty Exp:_____/____/_____ Life Exp:_____ Yrs.

Stock #:_____ NXRN:_____

Safety & Operation Inspection

1. Ground Resistance:_____ Ohms 2. Electrical Leakage:_____ ua

3. Operational/Functional/Check:_____

4. Manuals:

   A. Operational_____ B. Service:_____

   C. Schematics/Part List/Diagrams:_____

5. Set Up/Assembled By: BMET_____ Vendor:_____

6. Technical/Maintenance Training Needed? Yes:_____ No:_____

Accepted/Not Accepted By:_____ Date:_____/____/_____

Comments:_____

PM Program Evaluation/Assignment

1. Equipment Category:_____ 2.Resp. Shop:_____

3. Has this type of equipment been evaluated before: Yes:_____ No:_
_____

4. PM: A. Electrical Safety Inspection Only Yes:_____ No:_
_____
B. PM Needs, PM Program Guide No.: Yes:_____ No:_____, or
C. None (Circle)

5. Feq/hr.:_____ Standard Equipment Category Freq, Hours & Criticality

Change Defaults: Freq:_____Hours :_____ Criticality:____

Freq: Hours:_____ Criticality:_____

1.3.3 Final Approved Shop Drawings

Furnish final approved project shop drawings 30 days after transfer of the completed facility.

1.3.4 Construction Contract Specifications

Furnish final record (as-built) construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.3.5 Real Property Equipment

Furnish a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Furnish a draft list at time of transfer. Furnish the final list 30 days after transfer of the completed facility.

1.4 SPARE PARTS DATA

Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.
Supply one items of each part for spare parts inventory. Provision of spare parts does not relieve the Contractor of responsibilities listed under the contract guarantee provisions.

1.5 PREVENTATIVE MAINTENANCE

Submit Preventative Maintenance and Condition Monitoring (Predictive Testing) and Inspection schedules with instructions that state when systems should be retested.
Define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a signoff blank for the Contractor and Contracting Officer for each test feature; e.g., gpm, rpm, psi.
Include a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventative maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9, "Certification and Estimate of Percentage of Recovered Material Content for EPA Designated Items". Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and

certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials:

1) The product does not meet appropriate performance standards;
2) The product is not available within a reasonable time frame;
3) The product is not available competitively (from two or more sources);
4) The product is only available at an unreasonable price (compared with a comparable non-recycled content product)." Record each product used in the project that has a requirement or option of containing recycled content in accordance with Section 01 62 35 RECYCLED/RECOVERED MATERIALS, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, exemptions (1, 2, 3, or 4, as indicated), and comments. Recycled content values may be determined by weight or volume percent, but must be consistent throughout.

1.7 WARRANTY MANAGEMENT

1.7.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to the clause Warranty of Construction in the FAR & the VAAR. At least 30 days before the planned pre-warranty conference, submit the warranty management plan for Government approval. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly

pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of project acceptance and continue for the full product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Include within the warranty management plan , but not limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the contractors, sub-contractors, manufacturers or suppliers involved.
b. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.
c. A list for each warranted equipment, item, feature of construction or system indicating:
    1. Name of item.
    2. Model and serial numbers.
    3. Location where installed.
    4. Name and phone numbers of manufacturers or suppliers.
    5. Names, addresses and telephone numbers of sources of spare parts.
    6. Warranties and terms of warranty. Include one-year overall warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
    7. Cross-reference to warranty certificates as applicable.
    8. Starting point and duration of warranty period.
    9. Summary of maintenance procedures required to continue the warranty in force.
    10. Cross-reference to specific pertinent Operation and Maintenance manuals.

11. Organization, names and phone numbers of persons to call for warranty service.
12. Typical response time and repair time expected for various warranted equipment.

d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

e. Procedure and status of tagging of all equipment covered by extended warranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.7.2 Performance Bond

The Contractor's Performance Bond must remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.7.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, be continuously available, and shall be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.7.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframes specified, the Government will perform the work and back charge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems
(1) Recreational support.
(2) Air conditioning leak in part of building, if causing damage.
(3) Air conditioning system not cooling properly.

Code 1-Doors
(1) Overhead doors not operational, causing a security, fire, or safety problem.
(2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors
(1) Overhead doors not operational.
(2) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical
(1) Power failure (entire area or any building operational after 1600 hours).
(2) Security lights
(3) Smoke detectors

Code 2-Electrical
(1) Power failure (no power to a room or part of building).
(2) Receptacle and lights (in a room or part of building).

Code 3-Electrical
Street lights.

Code 1-Gas
(1) Leaks and breaks.
(2) No gas to family housing unit or cantonment area.

Code 1-Heat
(1). Area power failure affecting heat.
(2). Heater in unit not working.

Code 1-Plumbing

(1) Hot water heater failure.
(2) Leaking water supply pipes.

Code 2-Plumbing
(1) Flush valves not operating properly.
(2) Fixture drain, supply line to commode, or any water pipe leaking.
(3) Commode leaking at base.

Code 3 -Plumbing
Leaky faucets.

Code 3-Interior
(1) Floors damaged.
(2) Paint chipping or peeling.
(3) Casework.

Code 1-Roof Leaks
Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Hot)
No hot water in portion of building listed.

Code 3-All other work not listed above.

1.7.5 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attached each tag with a copper wire and spray with a silicone waterproof coating. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

a. Type of product/material_____.

b. Model number_____.

c. Serial number_____.

d. Contract number_____.

e. Warranty period_____from_____to_____.

f. Inspector's signature_____.

g. Construction Contractor_____.

Address_____.

Telephone number_____.

h. Warranty contact_____.

Address_____.

Telephone number_____.

i. Warranty response time priority code_____.

j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

1.8 MECHANICAL TESTING AND BALANCING

All contract requirements of Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC must be fully completed, including all testing, prior to contract completion date. In addition, all contract requirements of Section 23 08 00.00 20 HVAC TESTING/ADJUSTING/BALANCING must be fully completed, including testing and inspection, prior to contract completion date, except as noted otherwise in Section 23 08 00.00 20. The time required to complete all work and testing as prescribed by Sections 23 09 23.13 20 and 23 08 00.00 20 is included in the allotted calendar days for completion.

1.9 OPERATION AND MAINTENANCE MANUALS

Operation and Maintenance Manuals must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals must have 0.3937-inch holes and be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions. These services must be directed by the Contractor, using

the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given 7 calendar days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, must be made available to the Contracting Officer.

Submit three copies of the project operation and maintenance manuals 30 calendar days prior to testing the system involved. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

1.10 CLEANUP

Provide final cleaning in accordance with ASTM E 1971. Leave premises "disinfected mop & wipe clean”. Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment and comply with the Indoor Air Quality (IAQ) Management Plan. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with the Waste Management Plan. Promptly and legally transport and dispose of any trash. Do not burn, bury, or otherwise dispose of trash on the project site.

1.10.1 Extraordinary Cleanup Requirements

The following cleanup requirements apply: Ductwork & coils shall be cleaned at the turnover of the areas for beneficial occupancy.

1.11 REAL PROPERTY RECORD

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft attached to this section, and submit an accounting of all installed property on Form DD1354 "Transfer and Acceptance of Military Real Property." Contact the Project Engineer for any project specific information necessary to complete the DD Form 1354. For information purposes, a blank DD Form 1354 (fill-able) in ADOBE (PDF) may be obtained at the following web site:

http://www.dtic.mil/whs/directives/infomgt/forms/eforms/dd1354.pdf

Submit the completed Checklist for Form DD1354 of Government-Furnished and Contractor-Furnished/Contractor Installed items. Attach this list to the updated DD Form 1354. Instructions for completing the form and a blank checklist (fill-able) in ADOBE (PDF) may be obtained at the following web site:

http://www.hnd.usace.army.mil/techinfo/UFC/UFC1-300-08/UFC1-300-08.pdf

See Appendix D of this pdf for the checklist.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 1971(2005) Stewardship for the Cleaning of Commercial and Institutional Buildings

1.2 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors shall compile and prepare data and deliver to the Contractor prior to the training of Government personnel. The Contractor shall compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.2.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.2.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Commissioned items without a specified data package requirement in the individual technical sections shall use Data Package 5. Commissioned items with a Data Package 1 or 2 requirement shall use instead Data Package 4.

1.2.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.2.4 Review and Approval

The Contractor's Commissioning Authority (CA) shall review the commissioned systems and equipment submittals for completeness and applicability. The CA shall verify that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CA shall communicate deficiencies to the Contracting Officer. Upon a successful review of the corrections, the CA shall recommend approval and acceptance of these O&M manuals to the Contracting Officer. This work shall be in addition to the normal review procedures for O&M data.

1.2.5 O&M Database

Develop a database from the O&M manuals that contains the information required to start a preventative maintenance program.

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.3.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.3.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.3.1.2 Operator Prestart

Include procedures required to install, set up, and prepare each system for use.

1.3.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.3.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.3.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies.

Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.3.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

1.3.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.3.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

c. A Lubrication Schedule showing service interval frequency.

1.3.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.3.2.3 Cleaning Recommendations

Provide environmentally preferable cleaning recommendations in accordance with ASTM E 1971.

1.3.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.3.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.3.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.3.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.3.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.3.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.3.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.3.5.1 Product Submittal Data

Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

1.3.5.2 Manufacturer's Instructions

Provide a copy of all SD-08 Manufacturer's Instructions submittals required in the applicable technical sections.

1.3.5.3 O&M Submittal Data

Provide a copy of all SD-10 Operation and Maintenance Data submittals required in the applicable technical sections.

1.3.5.4 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

1.3.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.3.5.6 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.3.5.7 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.3.5.8 Testing and Performance Data

Include completed pre-functional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

1.3.5.9 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.4 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

Include Data Package 5 and the following for control systems:

a. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

b. Full as-built sequence of operations.

c. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).

d. Full points list. A listing of rooms shall be provided with the following information for each room:

(1) Floor

(2) Room number

(3) Room name

(4) Air handler unit ID

(5) Reference drawing number

(6) Air terminal unit tag ID

(7) Heating and/or cooling valve tag ID

(8) Minimum cfm

(9) Maximum cfm

e. Full print out of all schedules and set points after testing and acceptance of the system.

f. Full as-built print out of software program.

g. Electronic copy on disk or CD of the entire program for this facility.

h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.5.1 Data Package 1

a. Safety precautions

b. Cleaning recommendations

c. Maintenance and repair procedures

d. Warranty information

e. Contractor information

f. Spare parts and supply list

1.5.2 Data Package 2

a. Safety precautions

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan and schedule

f. Cleaning recommendations

g. Maintenance and repair procedures

h. Removal and replacement instructions

i. Spare parts and supply list

j. Parts identification

k. Warranty information

l. Contractor information

1.5.3 Data Package 3

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Environmental conditions

g. Lubrication data

h. Preventive maintenance plan and schedule

i. Cleaning recommendations

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Product submittal data

p. O&M submittal data

q. Parts identification

r. Warranty information

s. Testing equipment and special tool information

t. Testing and performance data

u. Contractor information

1.5.4 Data Package 4

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Lubrication data

i. Preventive maintenance plan and schedule

j. Cleaning recommendations

k. Troubleshooting guides and diagnostic techniques

l. Wiring diagrams and control diagrams

m. Maintenance and repair procedures

n. Removal and replacement instructions

o. Spare parts and supply list

p. Corrective maintenance man-hours

q. Product submittal data

r. O&M submittal data

s. Parts identification

t. Warranty information

u. Personnel training requirements

v. Testing equipment and special tool information

w. Testing and performance data

x. Contractor information

1.5.5 Data Package 5

a. Safety precautions

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Product submittal data

m. Manufacturer's instructions

n. O&M submittal data

o. Parts identification

p. Testing equipment and special tool information

q. Warranty information

r. Testing and performance data

s. Contractor information

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

- - - E N D - - -

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI Guideline K(2005) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145(1991; R 2004) Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

AASHTO T 180(2001; R 2004) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6(2006) Safety Requirements for Demolition Operations

CARPET AND RUG INSTITUTE (CRI)

CRI 104(2002) Standard for Installation Specification of Commercial Carpet

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1(2003) Safety -- Safety and Health Requirements

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25(June 2000) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M(2006; Notice 1) Requisitioning and Issue Procedures

MIL-STD-129(Rev P; Notice 3; Change 4) Military Marking for Shipment and Storage

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1(Rev K) Obstruction Marking and Lighting

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61National Emission Standards for Hazardous Air Pollutants

40 CFR 82Protection of Stratospheric Ozone

49 CFR 173.301Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

1.2 GENERAL REQUIREMENTS

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes salvage and recycling of materials. The work includes demolition,, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions

SD-07 Certificates

Demolition Plan; G
Notifications
Notification of Demolition and Renovation forms; G

Proposed salvage, demolition, and removal procedures for approval before work is started.

SD-11 Closeout Submittals

Receipts

Receipts or bills of lading, as specified.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6.

1.4.1 Notifications

1.4.1.1 General Requirements

Furnish timely notification of demolition and renovation projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the State's environmental protection agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M.

1.4.2 Receipts

Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS).

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. HEPA vacuum and dust the work area daily.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Conditions Documentation

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document.

1.6.3 Items to be Relocated

Prior to commencement of any work, take necessary precautions to properly tag and index all existing equipment, furniture, etc. identified in the Contract Documents to be relocated. The General Contractor shall meet with the COTR and department facilitator to discuss and confirm each item that is identified as being relocated.

1.6.4 Items to Remain in Place

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.6.5 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

1.6.6 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

1.6.7 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

1.6.8 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of

any cutting, removal, deconstruction, or demolition work performed under this contract.

1.6.9 Protection of Personnel

Before, during and after the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.8 FOREIGN OBJECT DAMAGE (FOD) – Not applicable

1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Items to be relocated which are damaged by the Contractor shall be repaired or replaced with new undamaged items as approved by the Contracting Officer.

1.10 REQUIRED DATA

Prepare demolition plan documents. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reuse or recycling with reference to paragraph Existing Facilities to be Removed. Append tracking forms for all removed materials indicating type, quantities, condition, destination, and end use. Coordinate with Waste Management Plan. Include statements affirming Contractor inspection of the existing roof deck and its suitability to perform as a safe working platform or if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the work. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

1.11 ENVIRONMENTAL PROTECTION

Comply with the Environmental Protection Agency requirements specified.

1.12 USE OF EXPLOSIVES

Use of explosives will not be permitted.

1.13 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the schedule set forth by the West Haven VAMC:

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2 Carpet

Remove existing carpet for reclamation in accordance with manufacturer recommendations and as follows. Remove used carpet in large pieces, roll tightly, and pack neatly in a container. Remove adhesive according to recommendations of the Carpet and Rug Institute (CRI). Adhesive removal solvents shall comply with CRI 104. Recycle removed carpet cushion.

3.1.3 Acoustic Ceiling Tile

Remove, neatly stack, and recycle acoustic ceiling tiles. Recycling may be available with manufacturer. Otherwise, priority shall be given to a local recycling organization.

3.1.4 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

a. Concrete and Masonry: Completely fill holes and depressions, caused by previous physical damage or left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.

c. Patch acoustic lay-in ceiling where partitions have been removed. The transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

3.1.5 Air Conditioning Equipment

Remove air conditioning, refrigeration, and other equipment containing refrigerants without releasing chlorofluorocarbon refrigerants to the atmosphere in accordance with the Clean Air Act Amendment of 1990. Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)." Turn in salvaged Class I or II ODS refrigerants as specified in paragraph, "Salvaged Materials and Equipment."

3.1.6 Cylinders and Canisters

Remove all fire suppression system cylinders and canisters and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

3.1.7 Locksets on Swinging Doors

The Contractor shall remove all locksets from all swinging doors indicated to be removed and disposed of. Deliver the locksets and related items to a designated location for receipt by the Project Engineer after removal.

3.1.8 Mechanical Equipment and Fixtures

Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Mechanical equipment and fixtures must be disconnected at fittings. Remove service valves attached to the unit. Salvage each item of equipment and fixtures as a whole unit; listed, indexed, tagged, and stored. Salvage each unit with its normal operating auxiliary equipment. Transport salvaged equipment and fixtures, including motors and machines, to a designated on station storage area as directed by the Project Engineer. Do not remove equipment until approved. Do not offer low-efficiency equipment for reuse.

3.1.8.1 Preparation for Storage

Remove water, dirt, dust, and foreign matter from units; tanks, piping and fixtures shall be drained; interiors, if previously used to store flammable, explosive, or other dangerous liquids, must be steam cleaned. Seal openings with caps, plates, or plugs. Secure motors attached by flexible connections to the unit. Change lubricating systems with the proper oil or grease.

3.1.8.2 Piping

Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. Store salvaged piping according to size and type. If the piping that remains can become pressurized due to upstream valve failure, end caps, blind flanges, or other types of plugs or fittings with a pressure gage and bleed valve shall be attached to the open end of the pipe to ensure positive leak control. Carefully dismantle piping that previously contained gas, gasoline, oil, or other dangerous fluids, with precautions taken to prevent injury to persons and property. Store piping outdoors until all fumes and residues are removed. Box prefabricated supports, hangers, plates, valves, and specialty items according to size and type. Wrap sprinkler heads individually in plastic bags before boxing. Classify piping not designated for salvage, or not reusable, as scrap metal.

3.1.8.3 Ducts

Classify removed duct work as scrap metal unless it has been identified as Asbestos Containing Material (ACM) due to its mastic.

3.1.8.4 Fixtures, Motors and Machines

Remove and salvage fixtures, motors and machines associated with plumbing, heating, air conditioning, refrigeration, and other mechanical system installations. Salvage, box and store auxiliary units and accessories with the main motor and machines. Tag salvaged items for identification, storage, and protection from damage. Classify non-porcelain broken, damaged, or otherwise unserviceable units and not caused to be broken, damaged, or otherwise unserviceable as debris to be disposed of by the Contractor. Salvage and crush porcelain plumbing fixtures unsuitable for reuse.

3.1.9 Electrical Equipment and Fixtures

Salvage motors, motor controllers, and operating and control equipment that are attached to the driven equipment. Salvage wiring systems and components. Box loose items and tag for identification. Disconnect primary, secondary, control, communication, and signal circuits at the point of attachment to their distribution system.

3.1.9.1 Fixtures

Remove and salvage electrical fixtures. Salvage unprotected glassware from the fixture and salvage separately. Salvage incandescent,

mercury-vapor, and fluorescent lamps and fluorescent ballasts manufactured prior to 1982, boxed and tagged for identification, and protected from breakage.

3.1.9.2 Electrical Devices

Remove and salvage switches, switchgear, transformers, conductors including wire and nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panel boards, outlet boxes, and similar items. Box and tag these items for identification according to type and size.

3.1.9.3 Wiring Ducts or Troughs

Remove and salvage wiring ducts or troughs. Dismantle plug-in ducts and wiring troughs into unit lengths. Remove plug-in or disconnecting devices from the busway and store separately.

3.1.9.4 Conduit and Miscellaneous Items

Salvage conduit except where embedded in concrete or masonry. Consider corroded, bent, or damaged conduit as scrap metal. Sort straight and undamaged lengths of conduit according to size and type. Classify supports, knobs, tubes, cleats, and straps as debris to be removed and disposed.

3.1.10 Elevators and Hoists – Not applicable

3.1.11 Items With Unique/Regulated Disposal Requirements

Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner.

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor’s demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.2.2 Reuse of Materials and Equipment

Remove and store materials and equipment listed in the Demolition Plan to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.2.3 Salvaged Materials and Equipment

Remove materials and equipment that are listed in the Demolition Plan to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site , as directed within one miles of the work site.

a. Salvage items and material to the maximum extent possible.

b. Store all materials salvaged for the Contractor as approved by the Contracting Officer and remove from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

c. Remove salvaged items to remain the property of the Government in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage must be repaired or replaced to match existing items. Properly identify the contents of containers. Deliver the following items reserved as property of the Government to the areas designated: Building 24.

d. Remove the following items reserved as property of the using service prior to commencement of work under this contract: Refrigerators & Freezers in room 7203-7204.

e. Remove historical items in a manner to prevent damage. Deliver the following historical items to the Government for disposition: Corner stones, contents of corner stones, and document boxes wherever located on the site.

3.2.4 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting ARI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82.

3.2.4.1 Special Instructions

No more than one type of ODS is permitted in each container. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All

cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

a. Activity name and unit identification code

b. Activity point of contact and phone number

c. Type of ODS and pounds of ODS contained

d. Date of shipment

3.3.5.2 Fire Suppression Containers

Deactivate fire suppression system cylinders and canisters with electrical charges or initiators prior to shipment. Also, safety caps must be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

3.3.6 Transportation Guidance

Ship all ODS containers in accordance with 49 CFR 173.301.

3.4 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other non salvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified off the Medical center. Storage of removed materials on the project site is prohibited.

3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.5.3 Removal to Spoil Areas on Government Property

Transport noncombustible materials removed from demolition and deconstruction structures to designated spoil areas on Government property.

3.5.4 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

3.6 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

- - - END - - -

SECTION 02 82 14
ASBESTOS HAZARD CONTROL ACTIVITIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z9.2 (2001) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE Z87.1 (2003) Standard for Occupational and Educational Eye and Face Protection

ASTM INTERNATIONAL (ASTM)

ASTM D 1331(1989; R 2001) Surface and Interfacial Tension of Solutions of Surface-Active Agents

ASTM D 4397(2002) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

ASTM E 1368(2005e1) Visual Inspection of Asbestos Abatement Projects

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7(2003) Compressed Air for Human Respiration

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701(2004) Fire Tests for Flame Propagation of Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 94-113(1994; 4th Ed) NIOSH Manual of Analytical Methods

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1(2003) Safety -- Safety and Health Requirements

EP 1110-1-11(1997; Change 1) Asbestos Abatement Guideline Detail Sheets

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90/018(1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134Respiratory Protection

29 CFR 1910.141Sanitation

29 CFR 1910.147Control of Hazardous Energy (Lock Out/Tag Out)

29 CFR 1926.1101Asbestos

29 CFR 1926.32Safety and Health Regulations for Construction - Definition

40 CFR 61National Emission Standards for Hazardous Air Pollutants

40 CFR 763Asbestos

42 CFR 84Approval of Respiratory Protective Devices

49 CFR 107Hazardous Materials Program Procedures

49 CFR 171General Information, Regulations, and Definitions

49 CFR 172Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 173Shippers - General Requirements for Shipments and Packaging

UNDERWRITERS LABORATORIES (UL)

UL 586 (1996; Rev thru Aug 2004) Standard for High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 Amended Water

Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter when tested in accordance with ASTM D 1331.

1.2.2 Asbestos-Containing Material (ACM)

Any materials containing more than one percent asbestos.

1.2.3 Authorized Person

Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

1.2.4 Building Inspector

Individual who inspects buildings for asbestos and has EPA Model Accreditation Plan (MAP) "Building Inspector" training; accreditation required by 40 CFR 763, Subpart E, Appendix C, has EPA/State certification/license as a "Building Inspector".

1.2.5 Class I Asbestos Work

Activities defined by OSHA involving the removal of thermal system insulation (TSI) and surfacing ACM.

1.2.6 Class II Asbestos Work

Activities defined by OSHA involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos - containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic. Certain "incidental" roofing materials such as mastic, flashing and cements when they are still intact are excluded from Class II asbestos work. Removal of small amounts of these materials which would fit into a glovebag may be classified as a Class III job.

1.2.7 Class III Asbestos Work

Activities defined by OSHA that involve repair and maintenance operations, where ACM, including TSI and surfacing ACM, is likely to be disturbed. Operations may include drilling, abrading, cutting a hole, cable pulling, crawling through tunnels or attics and spaces above the ceiling, where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.

1.2.8 Class IV Asbestos Work

Maintenance and custodial construction activities during which employees contact but do not disturb ACM and activities to clean-up dust, waste and debris resulting from Class I, II, and III activities. This may include dusting surfaces where ACM waste and debris and accompanying dust exists and cleaning up loose ACM debris from TSI or surfacing ACM following construction

1.2.9 Clean Room

An uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

1.2.10 Competent Person

In addition to the definition in 29 CFR 1926.32(f), a person who is capable of identifying existing asbestos hazards as defined in 29 CFR 1926.1101, selecting the appropriate control strategy, has the authority to take prompt corrective measures to eliminate them and has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training; has EPA/State certification/license as a "Contractor/Supervisor".

1.2.11 Contractor/Supervisor

Individual who supervises asbestos abatement work and has EPA Model Accreditation Plan "Contractor/Supervisor" training; has EPA/State certification as a "Contractor/Supervisor".

1.2.12 Critical Barrier

One or more layers of plastic sealed over all openings into a regulated area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a regulated area from migrating to an adjacent area.

1.2.13 Decontamination Area

An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

1.2.14 Demolition

The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

1.2.15 Disposal Bag

A 6 mil thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926.1101, used for transporting asbestos waste from containment to disposal site.

1.2.16 Disturbance

Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in 1 standard sized glovebag or waste bag, not larger than 60 inches in length and width in order to access a building component.

1.2.17 Equipment Room or Area

An area adjacent to the regulated area used for the decontamination of employees and their equipment.

1.2.18 Fiber

A fibrous particulate, 5 micrometers or longer, with a length to width ratio of at least 3 to 1.

1.2.19 Friable ACM

A term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

1.2.20 Glovebag

Not more than a 60 by 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

1.2.21 High-Efficiency Particulate Air (HEPA) Filter

A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

1.2.22 Intact

ACM which has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix. Removal of "intact" asphaltic, resinous, cementitious products does not render the ACM non-intact simply by being separated into smaller pieces.

1.2.23 Model Accreditation Plan (MAP)

USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763.

1.2.24 Negative Initial Exposure Assessment

A demonstration by the Contractor to show that employee exposure during an operation is expected to be consistently below the OSHA Permissible Exposure Limits (PELs).

1.2.25 NESHAP

National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61, Subpart M.

1.2.26 Nonfriable ACM

A NESHAP term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material containing more than 1 percent asbestos that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

1.2.27 Non-friable ACM (Category I)

A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos.

1.2.28 Non-friable ACM (Category II)

A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning any material, excluding Category I non-friable ACM, containing more than 1 percent asbestos.

1.2.29 Permissible Exposure Limits (PELs)

1.2.29.1 PEL-Time Weighted Average (TWA)

Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8 hour time weighted average (TWA).

1.2.29.2 PEL-Excursion Limit

An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes.

1.2.30 Regulated Area

An OSHA term defined in 29 CFR 1926.1101 meaning an area established by the Contractor to demarcate areas where Class I, II, and III asbestos work is conducted; also any adjoining area where debris and waste from such asbestos work accumulate; and an area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the permissible exposure limit.

1.2.31 Removal

All operations where ACM is taken out or stripped from structures or substrates, and includes demolition operations.

1.2.32 Repair

Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM attached to structures or substrates.

1.2.33 Surfacing ACM

Asbestos-containing material which contains more than 1% asbestos and is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

1.2.34 Thermal System Insulation (TSI) ACM

ACM which contains more than 1% asbestos and is applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain or water condensation.

1.2.35 Transite

A generic name for asbestos cement wallboard and pipe.

1.2.36 Worker

Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926.1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation if required by the OSHA Class of work to be performed or by the state where the work is to be performed.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval.. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detailed Drawings G, Contracting Officer’s Industrial Hygienist (COIH)

Descriptions, detailed drawings, and site layout to include worksite containment area(s), local exhaust systems locations, decontamination units and load-out units, other temporary waste storage facility, access tunnels, location of temporary utilities (electrical, water, sewer) and boundaries of each regulated area.

SD-03 Product Data

Asbestos Waste Shipment Records; G COIH
Weight Bills and Delivery Tickets; G COIH

Waste shipment records, weight bills and delivery tickets.

Encapsulants; G COIH
Respiratory Protection Program; G COIH
Cleanup and Disposal; G COIH

Manufacturer's catalog data for all materials and equipment to be used, including brand name, model, capacity, performance characteristics and any other pertinent information. Test results and certificates from the manufacturer of encapsulants substantiating compliance with performance requirements of this specification. Material Safety Data Sheets for all chemicals to be used onsite in the same format as implemented in the Contractor's HAZARD COMMUNICATION PROGRAM. Data shall include, but shall not be limited to, the following items:

a. High Efficiency Filtered Air (HEPA) local exhaust equipment

b. Vacuum cleaning equipment

c. Pressure differential monitor for HEPA local exhaust equipment

d. Air monitoring equipment

e. Respirators

f. Personal protective clothing and equipment

g. Glovebags. Written manufacturer's proof that glovebags will not break down under expected temperatures and conditions.

h. Duct Tape

i. Disposal Containers

j. Sheet Plastic

k. Wetting Agent

l. Strippable Coating

m. Prefabricated Decontamination Unit

n. Material Safety Data Sheets (for all chemicals proposed)

Qualifications; G COIH

A written report providing evidence of qualifications for personnel, facilities and equipment assigned to the work.

Training Program

A copy of the written project site-specific training material as indicated in 29 CFR 1926.1101 that will be used to train onsite employees.

Licenses, Permits and Notifications; G COIH

Licenses, permits, and notifications.

SD-06 Test Reports

Exposure Assessment and Air Monitoring; G COIH

Initial exposure assessments, negative exposure assessments, air-monitoring results and documentation.

Local Exhaust System

Pressure differential recordings.

SD-07 Certificates

Local Exhaust System

Manufacturer's certifications showing compliance with ANSI Z9.2 for:
a. Vacuums.
b. Water filtration equipment.
c. Ventilation equipment.
d. Other equipment required to contain airborne asbestos fibers.

Encapsulants ; G COIH

Certificates stating that encapsulants meet the applicable specified performance requirements.

Medical Surveillance Requirements

Required medical certification and the Physician's written opinion.

1.4 DESCRIPTION OF WORK

This section covers all operations in which asbestos-containing materials (ACM) are encountered. These procedures and equipment are required to protect workers and building occupants from airborne asbestos fibers and ACM dust and debris. Activities include OSHA Class I and Class II work operations. This section also includes containment, storage, transportation and disposal of the generated ACM wastes. The Contractor shall submit Detailed Drawings in accordance with EP 1110-1-11 and as specified in the Submittals paragraph. When the detail sheets are not attached to this specification, the Contractor can get them from the web at: http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/esp1110-1-11/toc.htm

1.4.1 Abatement Work Tasks

The specific ACM to be abated is identified on [the detailed plans and project drawings] [Table 1]. A summary for each work task including the appropriate RESPONSE ACTION DETAIL SHEET (item to be abated and methods to be used) and SET-UP DETAIL SHEETS (containment techniques to include safety precautions and methods) is included in Table 1, "Individual Work Task Data Elements" at the end of this section.

1.4.2 Unexpected Discovery of Asbestos

For any previously untested building components suspected to contain asbestos and located in areas impacted by the work, the Contractor shall notify the Contracting Officer (CO) who will have the option of ordering up to 50 bulk samples to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM. If the asbestos content is less than 10 percent, as determined by a method other than point counting, the asbestos content shall be verified by point counting. Any additional components identified as ACM that have been approved by the CO for removal shall be removed by the Contractor and will be paid for by an equitable adjustment to the contract price under the CONTRACT CLAUSE titled "changes". Sampling shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course and is EPA/State certified/licensed as a "Building Inspector".

1.5 QUALIFICATIONS

1.5.1 Written Qualifications and Organization Report

The Contractor shall furnish a written qualifications and organization report providing evidence of qualifications of the Contractor, Contractor's Project Supervisor, Designated Competent Person, supervisors and workers; Designated IH; independent testing laboratory; all Subcontractors to be used including disposal transportation and disposal facility firms, subcontractor supervisors, subcontractor workers; and any others assigned to perform asbestos abatement and support activities. The report shall include an organization chart showing the Contractor's staff organization chain of command and reporting relationship with all Subcontractors. The report shall be signed by the Contractor, the Contractor's onsite project manager, Designated Competent Person, Designated IH, designated testing laboratory and the principals of all Subcontractors to be used. The Contractor shall include the following statement in the report: "By signing this report I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926.1101, 40 CFR 61, Subpart M, and the federal, state and local requirements for those asbestos abatement activities that they will be involved in."

1.5.2 Specific Requirements

The Contractor shall designate in writing, personnel meeting the following qualifications:

1.5.2.1 Asbestos Abatement Contractor

The Contractor shall be certified/licensed the State of Connecticut to perform asbestos-related activities.

1.5.2.2 Designated Competent Person

Evidence that the full-time Designated Competent Person is qualified in accordance with 29 CFR 1926.32 and 29 CFR 1926.1101, has EPA MAP "Contractor/Supervisor" training accreditation, has EPA/State certification/license as a "Contractor/Supervisor" and is experienced in the administration and supervision of asbestos abatement projects, including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite, etc. The Designated Competent Person shall be responsible for compliance with applicable federal, state and local requirements, the Contractor's Accident Prevention Plan (APP) and Asbestos Hazard Abatement Plan (AHAP). The Contractor shall submit the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training, [EPA/State certification/license] with the employee "Certificate of Worker Acknowledgment". The Contractor shall submit evidence that this person has a

minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA competent person requirements. The Designated Competent Person shall be onsite at all times during the conduct of this project.

1.5.2.3 Project and Other Supervisors

Evidence that the Project Supervisor and other supervisors have EPA MAP "Contractor/Supervisor" training accreditation. The Contractor shall submit the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training, EPA/State certification/license with the employee "Certificate of Worker Acknowledgment". The Contractor shall submit evidence that the Project Supervisor has a minimum of 2 years of on-the-job asbestos abatement experience relevant to project supervisor responsibilities and the other supervisors have a minimum of 1 year on-the-job asbestos abatement experience commensurate with the responsibilities they will have on this project.

1.5.2.4 Designated Industrial Hygienist

The Contractor shall provide the resume for the Industrial Hygienist (IH) selected to prepare the Contractor's AHAP, prepare and perform training, direct air monitoring and assist the Contractor's Competent Person in implementing and ensuring that safety and health requirements are complied with during the performance of all required work. The Designated IH shall be a person who is board eligible (meets all education and experience requirements)] as determined and documented by the American Board of Industrial Hygiene (ABIH), has EPA MAP "Contractor/Supervisor" training accreditation, [has EPA/State certification/license], and has a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities. The Contractor shall submit the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training and EPA/State certification/license with the employee "Certificate of Worker Acknowledgment". The Designated IH shall be completely independent from the Contractor according to federal, state, or local regulations; that is, shall not be a Contractor's employee or be an employee or principal of a firm in a business relationship with the Contractor negating such independent status. A copy of the Designated IH's current valid ABIH certification or confirmation of eligibility in writing from the ABIH shall be included. The Designated IH shall be onsite at all times for the duration of asbestos activities and shall be available for emergencies. In addition, the Contractor shall submit resumes of additional IH's and industrial hygiene technicians (IHT) who will be assisting the Designated IH in performing onsite tasks. IHs and IHTs supporting the Designated IH shall have a minimum of 2 years of practical onsite asbestos abatement experience. The formal reporting relationship between the Designated IH and the support IHs and IHTs, the Designated Competent Person, and the Contractor shall be indicated.

1.5.2.5 Asbestos Abatement Workers

Asbestos abatement workers shall meet the requirements contained in 29 CFR 1926.1101, 40 CFR 61, Subpart M, and other applicable federal, state and local requirements. Worker training documentation shall be provided as required on the "Certificate of Workers Acknowledgment".

1.5.2.6 Worker Training and Certification of Worker Acknowledgment

Training documentation is required for each employee who will perform OSHA Class I, Class II, Class III, or Class IV asbestos abatement operations. Such documentation shall be submitted on a Contractor generated form titled "Certificate of Workers Acknowledgment", to be completed for each employee in the same format and containing the same information as the example certificate at the end of this section. Training course completion certificates (initial and most recent update refresher) required by the information checked on the form shall be attached.

1.5.2.7 Physician

The Contractor shall provide the resume of the physician who will or has performed the medical examinations and evaluations of the persons who will conduct the asbestos abatement work tasks. The physician shall be currently licensed by the state where the workers will be or have been examined, have expertise in pneumoconiosis and shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1926.1101. The physician shall be familiar with the site's hazards and the scope of this project.

1.5.2.8 Independent Testing Laboratory

The Contractor shall identify the independent testing laboratory selected to perform the sample analyses and report the results. The testing laboratory shall be completely independent from the Contractor as recognized by federal, state or local regulations. Written verification of the following criteria, signed by the testing laboratory principal and the Contractor, shall be submitted:

(1) Phase contrast microscopy (PCM): The laboratory is fully equipped and proficient in conducting PCM of airborne samples using the methods specified by 29 CFR 1926.1101, OSHA method ID-160, the most current version of NIOSH 94-113 Method 7400. The laboratory shall be currently judged proficient (classified as acceptable) in counting airborne asbestos samples by PCM by successful participation in each of the last 4 rounds in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program or by participating in the AIHA PAT Program, and being judged proficient in counting samples.

(2) Polarized light microscopy (PLM): The laboratory is fully equipped and proficient in conducting PLM analyses of suspect ACM bulk samples in accordance with 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for bulk asbestos analysis and will use analysts with demonstrated proficiency to conduct PLM analyses.

(3) Transmission electron microscopy (TEM): The laboratory is [fully equipped and proficient in conducting TEM analysis of airborne samples using the mandatory method specified by 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for airborne sample analysis of asbestos by TEM; the laboratory will use analysts with demonstrated proficiency under NVLAP.] [proficient in conducting analysis for low asbestos concentration, enhanced analysis of floor tiles and bulk materials where multiple layers are present, using an improved EPA test method titled, "Method for the Determination of Asbestos in Bulk Building Materials".]

(4) PCM/TEM: The laboratory is fully equipped and each analyst is proficient in conducting PCM and TEM analysis of airborne samples using NIOSH 94-113 Method 7400 PCM and NIOSH 94-113 Method 7402 (TEM confirmation of asbestos content of PCM results) from the same filter.

1.5.2.9 Disposal Facility, Transporter

The Contractor shall provide written evidence that the landfill to be used is approved for asbestos disposal by the USEPA and State of Connecticut regulatory agencies. Copies of signed agreements between the Contractor (including Subcontractors and transporters) and the asbestos waste disposal facility to accept and dispose of all asbestos containing waste shall be provided. The Contractor and transporters shall meet the DOT requirements of 49 CFR 171, 49 CFR 172, and 49 CFR 173 as well as registration requirements of 49 CFR 107 and other applicable state or local requirements. The disposal facility shall meet the requirements of 40 CFR 61, Sections 154 or .155, as required in 40 CFR 61 150(b), and other applicable state or local requirements.

1.5.3 Federal, State or Local Citations on Previous Projects

The Contractor and all Subcontractors shall submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, a negative declaration signed by an officer of the company shall be provided.

1.6 REGULATORY REQUIREMENTS

In addition to detailed requirements of this specification, work performed under this contract shall comply with EM 385-1-1, applicable federal, state, and local laws, ordinances, criteria, rules and regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements

shall apply. The following state and local laws, rules and regulations regarding demolition, removal, encapsulation, construction alteration, repair, maintenance, renovation, spill/emergency cleanup, housekeeping, handling, storing, transporting and disposing of asbestos material apply.

1.7 SAFETY AND HEALTH PROGRAM AND PLANS

The Contractor shall prepare a written comprehensive site-specific Accident Prevention Plan (APP) at least 30 days prior to the preconstruction conference. The APP shall be in accordance with the format and requirements in Appendix A of EM 385-1-1. The APP shall incorporate an Asbestos Hazard Abatement Plan (AHAP), and Activity Hazard Analyses (AHAs) as separate appendices into one site-specific document. The APP shall take into consideration all the individual asbestos abatement work tasks identified in Table 1. See Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS for additional requirements.

1.7.1 Asbestos Hazard Abatement Plan Appendix

The AHAP shall include, but not be limited to, the following:

a. The personal protective equipment to be used;

b. The location and description of regulated areas including clean and dirty areas, access tunnels, and decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit);

c. Initial exposure assessment in accordance with 29 CFR 1926.1101;

d. Level of supervision;

e. Method of notification of other employers at the worksite;

f. Abatement method to include containment and control procedures;

g. Interface of trades;

h. Sequencing of asbestos related work;

i. Storage and disposal procedures and plan;

j. Type of wetting agent and asbestos encapsulant;

k. Location of local exhaust equipment;

l. Air monitoring methods (personal, environmental and clearance);

m. Bulk sampling and analytical methods (if required);

n. A detailed description of the method to be employed in order to control the spread of ACM wastes and airborne fiber;

o. Fire and medical emergency response procedures;

p. The security procedures to be used for all regulated areas.

1.7.2 Activity Hazard Analyses Appendix

AHAs for each major phase of work shall be submitted and updated during the project. The AHAs format shall be in accordance with Figure 1-1 of EM 385-1-1. The analysis shall define the activities to be performed for a major phase of work, identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the AHA has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the onsite Government representatives. The AHAs shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations.

1.8 PRECONSTRUCTION CONFERENCE

The Contractor and the Contractor's Designated Competent Person, Project Supervisor, and Designated IH shall meet with the Contracting Officer (CO) prior to beginning work at a safety preconstruction conference to discuss the details of the Contractor's submitted APP to include the AHAP and AHAs appendices. Deficiencies in the APP will be discussed. Onsite work shall not begin until the APP has been accepted.

1.9 SECURITY

A locked entrance shall be provided for each regulated area. A log book shall be kept documenting entry into and out of the regulated area. Entry into regulated areas shall only be by personnel authorized by the Contractor and the CO. Personnel authorized to enter regulated areas shall be trained, medically evaluated, and wear the required personal protective equipment.

1.10 MEDICAL SURVEILLANCE REQUIREMENTS

Medical surveillance requirements shall conform to 29 CFR 1926.1101. Asbestos workers shall be enrolled in a medical surveillance program that meets 29 CFR 1926.1101 (m) requirements and other pertinent state or local requirements. This requirement shall have been satisfied within the last 12 months.

1.11 TRAINING PROGRAM

The Contractor shall establish a training program as specified by EPA MAP, training requirements at 40 CFR 763, the State of Connecticut regulations , OSHA requirements at 29 CFR 1926.1101 (k)(9). Contractor employees shall complete the required training for the type of work they are to perform and such training shall be documented and provided to the CO.

a. [Class I and II operations 32 hours Asbestos Worker Training]
b. [Class II generic removal 8 hour Asbestos Worker Training]
c. [Class III operations 16 hour O & M Training]
d. [Class IV operations 2 hour Awareness Training]

Prior to commencement of work the Contractor's Designated IH and Competent Person shall instruct each worker about:

a. The hazards and health effects of the specific types of ACM to be abated; and

b. The content and requirements of the Contractor's APP to include the AHAP and AHAs and site-specific safety and health precautions.

1.12 RESPIRATORY PROTECTION PROGRAM

The Contractor's Designated IH shall establish in writing, and implement a respiratory protection program in accordance with 29 CFR 1926.1101 and 29 CFR 1910.134. The Contractor's Designated IH shall establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations.

1.12.1 Respiratory Fit Testing

The Contractor's Designated IH shall conduct a qualitative or quantitative fit test conforming to Appendix A of 29 CFR 1910.134 for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test shall be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that will affect the fit, a new fit test shall be performed. Functional fit checks shall be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.12.2 Respirator Selection and Use Requirements

The Contractor shall provide respirators, and ensure that they are used as required by 29 CFR 1926.1101 and in accordance with CGA G-7 and the manufacturer's recommendations. Respirators shall be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. For air-purifying respirators, the particulate filter shall be high-efficiency particulate air (HEPA)/(N-,R-,P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type shall be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered.

1.13 LICENSES, PERMITS AND NOTIFICATIONS

Necessary licenses, permits and notifications shall be obtained in conjunction with the project's asbestos abatement, transportation and disposal actions and timely notification furnished of such actions as required by federal, state, regional, and local authorities. The Contractor shall notify the Regional Office of the USEPA, the State of Connecticut Department of Public Health and the CO in writing, at least 10 business days prior to the commencement of work, in accordance with 40 CFR 61, Subpart M, and state and local requirements to include the mandatory "Notification of Demolition and Renovation Record" form and other required notification

documents. Notification shall be by Certified Mail, Return Receipt Requested. The Contractor shall furnish copies of the receipts to the CO, in writing, prior to the commencement of work The Contractor is responsible for the associated fees/costs for licenses, permits, and notifications.

1.14 PERSONAL PROTECTIVE EQUIPMENT

Twenty complete sets of personal protective equipment shall be made available to the CO and authorized visitors for entry to the regulated area. The CO and authorized visitors shall be provided with training equivalent to that provided to Contractor employees in the selection, fitting, and use of personal protective equipment and the site safety and health requirements. Contractor workers shall be provided with personal protective clothing and equipment and the Contractor shall ensure that it is worn properly. The Contractor's Designated IH and Designated Competent Person shall select and approve all the required personal protective clothing and equipment.

1.14.1 Respirators

Respirators shall be in accordance with paragraph RESPIRATORY PROTECTION PROGRAM.

1.14.2 Whole Body Protection

Personnel exposed to or having the potential to be exposed to airborne concentrations of asbestos that exceed the PELs, or for all OSHA Classes of work for which a required negative exposure assessment is not produced, shall be provided with whole body protection and such protection shall be worn properly. Disposable whole body protection shall be disposed of as asbestos contaminated waste upon exiting from the regulated area. Reusable whole body protection worn shall be either disposed of as asbestos contaminated waste upon exiting from the regulated area or be properly laundered in accordance with 29 CFR 1926.1101. The Contractor's Designated Competent Person, in consultation with the Designated IH, has the authority to take immediate action to upgrade or downgrade whole body protection when there is an immediate danger to the health and safety of the wearer.

1.14.2.1 Coveralls

Disposable-impermeable coveralls with a zipper front shall be provided. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles. See DETAIL SHEET 13.

1.14.2.2 Gloves

Gloves shall be provided to protect the hands where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.).

1.14.2.3 Foot Coverings

Cloth socks shall be provided and worn next to the skin. Footwear, as required by OSHA and EM 385-1-1, that is appropriate for safety and health hazards in the area shall be worn. Reusable footwear removed from the

regulated area shall be thoroughly decontaminated or disposed of as ACM waste.

1.14.2.4 Head Covering

Hood type disposable head covering shall be provided. In addition, protective head gear (hard hats) shall be provided as required. Hard hats shall only be removed from the regulated area after being thoroughly decontaminated.

1.14.2.5 Protective Eye Wear

Eye protection shall be provided, when operations present a potential eye injury hazard, and shall meet the requirements of ASSE/SAFE Z87.1.

1.15 HYGIENE FACILITIES AND PRACTICES

The Contractor shall establish a decontamination area for the decontamination of employees, material and equipment. The Contractor shall ensure that employees enter and exit the regulated area through the decontamination area.

1.15.1 3-Stage Decontamination Area

A temporary negative pressure decontamination unit that is adjacent and attached in a leak-tight manner to the regulated area shall be provided as described in SET-UP DETAIL SHEET Numbers 22 and 23. The decontamination unit shall have an equipment room and a clean room separated by a shower that complies with 29 CFR 1910.141, unless the Contractor can demonstrate that such facilities are not feasible. Equipment and surfaces of containers filled with ACM shall be cleaned prior to removing them from the equipment room or area. Two separate lockers shall be provided for each asbestos worker, one in the equipment room and one in the clean room. The Contractor shall provide a minimum of 1 shower for every six (6) workers. Wastewater shall be collected and filtered to remove asbestos contamination. Filters and residue shall be disposed of as asbestos contaminated material, per DETAIL SHEETS 9A and 14. Filtered water shall be discharged to the sanitary sewer system. Wastewater filters shall be installed in series with the first stage pore size of 20 microns and the second stage pore size of 5 microns. The floor of the decontamination unit's clean room shall be kept dry and clean at all times. Proper housekeeping and hygiene requirements shall be maintained. Soap and towels shall be provided for showering, washing and drying. Any cloth towels provided shall be disposed of as ACM waste or shall be laundered in accordance with 29 CFR 1926.1101.

1.15.2 Load-Out Unit

A temporary load-out unit that is adjacent and connected to the regulated area shall be provided as described in DETAIL SHEET Number 25. The load-out unit shall be attached in a leak-tight manner to each regulated area.

1.15.3 Single Stage Decontamination Area

A decontamination area (equipment room/area) shall be provided for Class I work involving less than 25 feet or 10 square feet of TSI or surfacing ACM, and for Class II and Class III asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment. The equipment room or area shall be adjacent to the regulated area for the decontamination of employees, material, and their equipment which could be contaminated with asbestos. The area shall be covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area.

1.15.4 Decontamination Area Exit Procedures

The Contractor shall ensure that the following procedures are followed:

a. Before leaving the regulated area, remove all gross contamination and debris from work clothing using a HEPA vacuum.

b. Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers (see Detail Sheets 9A and 14) for disposal and/or laundering.

c. Employees shall not remove their respirators until showering.

d. Employees shall shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, the Contractor shall ensure that employees engaged in Class I asbestos jobs: a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or b) Remove their contaminated work suits in the equipment room, without cleaning work suits, and proceed to a shower that is not adjacent to the work area.

1.15.5 Smoking

Smoking, if allowed by the Contractor, shall only be permitted in designated areas approved by the CO.

1.16 REGULATED AREAS

All Class I, II, and III asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Access to regulated areas shall be limited to authorized persons. The Contractor shall control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

1.17 WARNING SIGNS AND TAPE

Warning signs and tape printed bilingually in English and Spanish shall be provided at the regulated boundaries and entrances to regulated areas. Signs shall be located to allow personnel to read the signs and take the necessary protective steps required before entering the area. Warning signs, as shown and described in DETAIL SHEET 11, and displaying the following legend in the lower panel:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA]

See DETAIL SHEET 11 and DETAIL SHEET 15.
Decontamination unit signage shall be as shown and described on DETAILED SHEET 15.

1.18 WARNING LABELS

Warning labels shall be affixed to all asbestos disposal containers, asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements are acceptable. See DETAIL SHEET 14,

1.19 LOCAL EXHAUST SYSTEM

Local exhaust units shall conform to ANSI Z9.2 and 29 CFR 1926.1101. Filters on local exhaust system equipment shall conform to ANSI Z9.2 and UL 586. Filter shall be UL labeled.

1.20 TOOLS

Vacuums shall be equipped with HEPA filters, of sufficient capacity and necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.

1.21 RENTAL EQUIPMENT

If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment.

1.22 AIR MONITORING EQUIPMENT

The Contractor's Designated IH shall approve air monitoring equipment. The equipment shall include, but shall not be limited to:

a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute.

b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit which shall maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands for personal air sampling.

d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands when conducting environmental area sampling using NIOSH 94-113 Methods 7400 and 7402, (and the transmission electric microscopy method specified at 40 CFR 763 if required).

e. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

1.23 EXPENDABLE SUPPLIES

1.23.1 Glovebag

Glovebags shall be provided as described in 29 CFR 1926.1101 and SET-UP DETAIL SHEET 10. The glovebag assembly shall be 6 mil thick plastic, prefabricated and seamless at the bottom with preprinted OSHA warning label.

1.23.2 Duct Tape

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container.

1.23.3 Disposal Containers

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers shall be provided for ACM wastes as required by 29 CFR 1926.1101 and DETAIL SHEETS 9A, 9B, 9C and 14. Disposal containers can be in the form of:

a. Disposal Bags

b. Fiberboard Drums

c. Cardboard Boxes

1.23.4 Sheet Plastic

Sheet plastic shall be polyethylene of 6 mil minimum thickness and shall be provided in the largest sheet size necessary to minimize seams. Film shall be clear or frosted and conform to ASTM D 4397, except as specified below:

1.23.4.1 Flame Resistant

Where a potential for fire exists, flame-resistant sheets shall be provided. Film shall be frosted and shall conform to the requirements of NFPA 701.

1.23.4.2 Reinforced

Reinforced sheets shall be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between 2 layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

1.23.5 Mastic Removing Solvent

Mastic removing solvent shall be nonflammable and shall not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite shall have a flash point greater than 140 degrees F.

1.23.6 Leak-tight Wrapping

Two layers of 6 mil minimum thick polyethylene sheet stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags as described in DETAIL SHEET 9B. Upon placement of the ACM component or material, each layer shall be individually leak-tight sealed with duct tape.

1.23.7 Viewing Inspection Window

Where feasible, a minimum of 1 clear, 1/8 inch thick, acrylic sheet, 18 by 24 inches, shall be installed as a viewing inspection window at eye level on a wall in each containment enclosure. The windows shall be sealed leak-tight with industrial grade duct tape.

1.23.8 Wetting Agents

Amended water shall meet the requirements of ASTM D 1331. Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS.

1.23.9 Strippable Coating

Strippable coating in aerosol cans shall be used to adhere to surfaces and to be removed cleanly by stripping, at the completion of work.

PART 2 PRODUCTS

2.1 ENCAPSULANTS

Encapsulants shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvent.

2.2 ENCASEMENT PRODUCTS

Encasement shall consist of primary cellular polymer coat, polymer finish coat, and any other finish coat as approved by the CO.

2.3 RECYCLABLE MATERIALS

Recyclable materials shall conform to EPA requirements in accordance with Section 01 62 35 RECYCLED/RECOVERED MATERIALS.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Asbestos abatement work tasks shall be performed [as shown on the detailed plans and drawings,] as summarized in Table 1. The Contractor shall use the engineering controls and work practices required in 29 CFR 1926.1101(g) in all operations regardless of the levels of exposure. Personnel shall wear and utilize protective clothing and equipment. The Contractor shall not permit eating, smoking, drinking, chewing or applying cosmetics in the regulated area. Personnel of other trades shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions of the Contractor's APP are complied with. Power to the regulated area shall be locked-out and tagged in accordance with 29 CFR 1910.147, and temporary electrical service with ground fault circuit interrupters shall be provided as needed. Temporary electrical service shall be disconnected when necessary for wet removal. The Contractor shall stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. The Contractor shall correct the condition to the satisfaction of the CO, including visual inspection and air sampling. Work shall resume only upon notification by the CO. Corrective actions shall be documented.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN

Asbestos abatement shall be performed without damage to or contamination of adjacent work or area. Where such work or area is damaged or contaminated, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government. When spills occur, work shall stop in all effected areas immediately and the spill shall be cleaned. When

satisfactory visual inspection and air sampling analysis results are obtained and have been evaluated by the Contractor's Designated IH and the CO, work shall proceed.

3.3 OBJECTS

3.3.1 Removal of Mobile Objects

The Government will remove Furniture and equipment from the area of work before work begins.

3.3.2 Stationary Objects

Stationary objects shall be pre-cleaned using a HEPA vacuum followed by adequate wet wiping. Stationary objects and furnishings shall be covered with 2 layers of polyethylene and edges sealed with duct tape.

3.4 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS

Building ventilation system supply and return air ducts in a regulated area shall be shut down and isolated by lockable switch or other positive means in accordance with 29 CFR 1910.147 and isolated by airtight seals to prevent the spread of contamination throughout the system. The airtight seals shall consist of 2 layers of polyethylene. Edges to wall, ceiling and floor surfaces shall be sealed with industrial grade duct tape.

3.5 PRECLEANING

Surfaces within a regulated work area shall be pre-cleaned by HEPA vacuum and adequately wet wiped prior to establishment of containment.

3.6 METHODS OF COMPLIANCE

3.6.1 Mandated Practices

The specific abatement techniques and items identified shall be detailed in the Contractor's AHAP. The Contractor shall use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

a. Vacuum cleaners equipped with HEPA filters.

b. Wet methods or wetting agents except where it can be demonstrated that the use of wet methods is unfeasible due to the creation of electrical hazards, equipment malfunction, and in roofing.

c. Prompt clean-up and disposal.

d. Inspection and repair of polyethylene.

e. Cleaning of equipment and surfaces of containers prior to removing them from the equipment room or area.

3.6.2 Control Methods

The Contractor shall use the following control methods:

a. Local exhaust ventilation equipped with HEPA filter;

b. Enclosure or isolation of processes producing asbestos dust;

c. Where the feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PELs, the Contractor shall use them to reduce employee exposure to the lowest levels attainable and shall supplement them by the use of respiratory protection.

3.6.3 Unacceptable Practices

The following work practices shall not be used:

a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

b. Compressed air used to remove asbestos containing materials, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

c. Dry sweeping, shoveling, or other dry clean up.

d. Employee rotation as a means of reducing employee exposure to asbestos.

3.6.4 Class I Work Procedures

In addition to requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

a. A Competent Person shall supervise the installation and operation of the control methods.

b. For jobs involving the removal of more than 25 feet or 10 square feet of TSI or surfacing material, the Contractor shall place critical barriers over all openings to the regulated area.

c. HVAC systems shall be isolated in the regulated area by sealing with a double layer of plastic or air-tight rigid covers.

d. Impermeable drop cloths (6 mil or greater thickness) shall be placed on surfaces beneath all removal activity.

e. Where a negative exposure assessment has not been provided or where exposure monitoring shows the PEL was exceeded, the regulated area shall be ventilated with a HEPA unit and employees must use PPE.

3.6.5 Specific Control Methods for Class I Work

3.6.5.1 Negative Pressure Enclosure (NPE) System

The NPE system shall be as shown in SETUP DETAIL SHEET [2] [3] [4] [8]. The system shall provide at least 4 air changes per hour inside the containment. The local exhaust unit equipment shall be operated 24 hours per day until the containment is removed. The NPE shall be smoke tested for leaks at the beginning of each shift and be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Pressure differential shall be monitored continuously, 24 hours per day, with an automatic manometer recording instrument and Records shall be provided daily on the same day collected to the CO. The CO shall be notified immediately if the pressure differential falls below the prescribed minimum. The building ventilation system shall not be used as the local exhaust system for the regulated area. The NPE shall terminate outdoors unless an alternate arrangement is allowed by the CO. All filters used shall be new at the beginning of the project and shall be periodically changed as necessary and disposed of as ACM waste.

3.6.5.2 Glovebag Systems

Glovebag systems shall be as shown in SETUP DETAIL SHEET 10. Glovebags shall be used without modification, smoke-tested for leaks, and completely cover the circumference of pipe or other structures where the work is to be done. Glovebags shall be used only once and shall not be moved. Glovebags shall not be used on surfaces that have temperatures exceeding 150 degrees F. Prior to disposal, glovebags shall be collapsed using a HEPA vacuum. Before beginning the operation, loose and friable material adjacent to the glovebag operation shall be wrapped and sealed in 2 layers of plastic or otherwise rendered intact. At least 2 persons shall perform glovebag removal. Designated boundary limits for the asbestos work shall be established with rope or other continuous barriers and all other requirements for asbestos control areas shall be maintained, including area signage and boundary warning tape as specified in SET-UP DETAIL SHEET 11.

a. The Contractor shall attach HEPA vacuum systems to the bag to prevent collapse during removal of ACM.

b. The negative pressure glove boxes shall be fitted with gloved apertures and a bagging outlet and constructed with rigid sides from metal or other material which can withstand the weight of the ACM and water used during removal. A negative pressure shall be created in the system using a HEPA filtration system. The box shall be smoke tested for leaks prior to each use.

3.6.6 Class II Work

In addition to the requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

a. A Competent Person shall supervise the work.

b. For indoor work, critical barriers shall be placed over all openings to the regulated area.

c. Impermeable drop cloths shall be placed on surfaces beneath all removal activity.

3.6.7 Specific Control Methods for Class II Work

3.6.7.1 Vinyl and Asphalt Flooring Materials

When removing vinyl and asphalt flooring materials which contain ACM, the Contractor shall use the following practices as shown in RESPONSE ACTION DETAIL SHEET 59. Resilient sheeting shall be removed by adequately wet methods. Tiles shall be removed intact (if possible); wetting is not required when tiles are heated and removed intact. Flooring or its backing shall not be sanded. Scraping of residual adhesive and/or backing shall be performed using wet methods. Mechanical chipping is prohibited unless performed in a negative pressure enclosure. Dry sweeping is prohibited. The Contractor shall use vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) to clean floors.

3.6.10 Methods for Asphaltic Wrap

Removal or disturbance of pipeline asphaltic wrap shall be performed using wet methods.

3.6.11 Class I Asbestos Work Response Action Detail Sheets

The following Class I Asbestos Work Response Action Detail Sheet is specified on Table 1 for each individual work task to be performed:

a. Pipe Insulation (Using a Glovebag): See Sheet 87

b. Horizontal Pipe Insulation (Using a Containment Area): See Sheet 88

c. Pipe Insulation (Using a Mini-Containment Area): See Sheet 89

d. Pipe and Fitting Insulation (Using Glovebag): See Sheet 86

e. Duct Insulation Pin Mastic:.

3.6.12 Class II Asbestos Work Response Action Detail Sheets

The following Class II Asbestos Work Response Action Detail Sheet is specified on Table 1 for each individual work task to be performed:

a. Vinyl Asbestos Tile and Chemical Dissolution of Asbestos-Containing Adhesives on Concrete Floor System: See Sheet 59

b. Miscellaneous Asbestos-Containing Materials: See Sheet 45

3.7 FINAL CLEANING AND VISUAL INSPECTION

After completion of all asbestos removal work and the gross amounts of asbestos have been removed from every surface, any remaining visible accumulations of asbestos shall be collected. For all classes of indo0r asbestos abatement projects a final cleaning shall be performed using HEPA vacuum and wet cleaning of all exposed surfaces and objects in the regulated area. Upon completion of the cleaning, the Contractor shall conduct a visual pre-inspection of the cleaned area in preparation for a final inspection before final air clearance monitoring. The Contractor and the CO shall conduct a final visual inspection of the cleaned regulated area in accordance with ASTM E 1368 and document the results on the Final Cleaning and Visual Inspection as specified on the SET-UP DETAIL SHEET 19. If the CO rejects the clean regulated area as not meeting final cleaning requirements, the Contractor shall re-clean as necessary and have a follow-on inspection conducted with the CO. Re-cleaning and follow-up re-inspection shall be at the Contractor's expense.

3.8 LOCKDOWN

Prior to removal of plastic barriers and after final visual inspection, a (lockdown) encapsulant shall be spray applied to ceiling, walls, floors, and other surfaces in the regulated area.

3.9 EXPOSURE ASSESSMENT AND AIR MONITORING

3.9.1 General Requirements

a. Exposure assessment, air monitoring and analysis of airborne concentration of asbestos fibers shall be performed in accordance with 29 CFR 1926.1101, and the Contractor's air monitoring plan. Results of breathing zone samples shall be posted at the job site and made available to the CO.

b. Worker Exposure.

(1) The Contractor's Designated IH shall collect samples representative of the exposure of each employee who is assigned to work within a regulated area. Breathing zone samples shall be taken for at least 25 percent of the workers in each shift, or a minimum of 2, whichever is greater. Air monitoring results at the 95 percent confidence level shall be calculated as shown in Table 2 at the end of this section.

(2) The Contractor shall and The CO will provide an onsite independent testing laboratory with qualified analysts and appropriate equipment to conduct sample analyses of air samples using the methods prescribed in 29 CFR 1926.1101, to include NIOSH 94-113 Method 7400.]

(3) The Contractor's workers shall not be exposed to an airborne fiber concentration in excess of 1.0 f/cc, as averaged over a sampling period of 30 minutes. Should a personal excursion concentration of 1.0 f/cc expressed as a 30-minute sample occur inside a regulated work area, the Contractor shall stop work immediately, notify the Contracting Officer, and implement additional engineering controls and work practice controls

to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the CO.

c. Environmental Exposure

(1) All environmental air monitoring shall be performed by the Contractor's Designated IH and Contracting Officer's IH.

(2) Environmental and final clearance air monitoring shall be performed using NIOSH 94-113 Method 7400 (PCM) with optional confirmation of results by TEM.

(3) For environmental and final clearance, air monitoring shall be conducted at a sufficient velocity and duration to establish the limit of detection of the method used at 0.005 f/cc.

(4) When confirming asbestos fiber concentrations (asbestos f/cc) from environmental and final clearance samples, use TEM in accordance with NIOSH 94-113 Method 7402. When such confirmation is conducted, it shall be from the same sample filter used for the NIOSH 94-113 Method 7400 PCM analysis. All confirmation of asbestos fiber concentrations, using NIOSH 94-113 Method 7402, shall be at the Contractor's expense.

(5) Monitoring may be duplicated by the Government at the discretion of the CO and at the Government's expense.

(6) The Contractor shall maintain a fiber concentration inside a regulated area less than or equal to 0.1 f/cc expressed as an 8 hour, time-weighted average (TWA) during the conduct of the asbestos abatement.

(7) At the discretion of the Contracting Officer, fiber concentration may exceed 0.1 f/cc but shall not exceed 1.0 f/cc expressed as an 8-hour TWA. Should an environmental concentration of 1.0 f/cc expressed as an 8-hour TWA occur inside a regulated work area, the Contractor shall stop work immediately, notify the Contracting Officer, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the CO.

3.9.2 Initial Exposure Assessment

The Contractor's Designated IH shall conduct an exposure assessment immediately before or at the initiation of an asbestos abatement operation to ascertain expected exposures during that operation. The assessment shall be completed in time to comply with the requirements, which are triggered by exposure data or the lack of a negative exposure assessment, and to provide information necessary to assure that all control systems planned are appropriate for that operation. The assessment shall take into consideration both the monitoring results and all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the Contractor which indicate the levels of airborne asbestos likely to be encountered on the job. For Class I asbestos work, until the employer conducts exposure monitoring and documents that employees on that job will not be exposed in

excess of PELs, or otherwise makes a negative exposure assessment, the Contractor shall presume that employees are exposed in excess of the PEL-TWA and PEL-Excursion Limit.

3.9.3 Negative Exposure Assessment

The Contractor shall provide a negative exposure assessment for the specific asbestos job which will be performed. The negative exposure assessment shall be provided within 2 days of the initiation of the project and conform to the following criteria:

a. Objective Data: Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the PEL-TWA and PEL-Excursion Limit under those work conditions having the greatest potential for releasing asbestos.

b. Prior Asbestos Jobs: Where the Contractor has monitored prior asbestos jobs for the PEL and the PEL-Excursion Limit within 12 months of the current job, the monitoring and analysis were performed in compliance with asbestos standard in effect; the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the Contractor's current operations; the operations were conducted by employees whose training and experience are no more extensive than that of employees performing the current job; and these data show that under the conditions prevailing and which will prevail in the current workplace, there is a high degree of certainty that the monitoring covered exposure from employee exposures will not exceed the PEL-TWA and PEL-Excursion Limit.

c. Initial Exposure Monitoring: The results of initial exposure monitoring of the current job, made from breathing zone air samples that are representative of the 8-hour PEL-TWA and 30-minute short-term exposures of each employee. The monitoring covered exposure from operations which are most likely during the performance of the entire asbestos job to result in exposures over the PELs.

3.9.4 Independent Environmental Monitoring

The Government has retained an independent air monitoring firm to perform pre-abatement during abatement and final clearance air monitoring. The air monitoring Contractor has been provided a copy of the contract that includes this abatement work. The abatement Contractor will provide the air monitoring Contractor with an up-to-date copy of the accepted AHAP, APP and pertinent detailed drawings. The air monitoring Contractor is required to comply with the abatement Contractor's safety and health requirements. The abatement Contractor will coordinate all onsite activities with the air monitoring Contractor, the COR, and other affected parties as directed by the COR. The abatement Contractor will provide the air monitoring Contractor with an up-to-date schedule of abatement Contractor work activities. The air monitoring Contractor will coordinate with the abatement Contractor and the COR during the performance Government required air monitoring. The abatement Contractor is responsible for performing exposure assessment and personal air

monitoring of abatement Contractor's work. The air monitoring Contractor is responsible for performing these tasks for its employee.

3.9.5 Pre-abatement Environmental Air Monitoring

Pre-abatement environmental air monitoring shall be established 1 day prior to the masking and sealing operations for each regulated area to determine background concentrations before abatement work begins. As a minimum, pre-abatement air samples shall be collected using NIOSH 94-113 Method 7400, PCM at these locations: outside the building; inside the building, but outside the regulated area perimeter; and inside each regulated work area. One sample shall be collected for every 2000 square feet of floor space. At least 2 samples shall be collected outside the building. The PCM samples shall be analyzed within 24 hours; and if any result in fiber concentration greater than 0.01 f/cc, asbestos fiber concentration shall be confirmed using NIOSH 94-113 Method 7402 (TEM).

3.9.6 Environmental Air Monitoring During Abatement

Until an exposure assessment is provided to the CO, environmental air monitoring shall be conducted at locations and frequencies that will accurately characterize any evolving airborne asbestos fiber concentrations. The assessment shall demonstrate that the product or material containing asbestos minerals, or the abatement involving such product or material, cannot release airborne asbestos fibers in concentrations exceeding 0.01 f/cc as a TWA under those work conditions having the greatest potential for releasing asbestos. The monitoring shall be at least once per shift at locations including, but not limited to, close to the work inside a regulated area; pre-abatement sampling locations; outside entrances to a regulated area; close to glovebag operations; representative locations outside of the perimeter of a regulated area; inside clean room; and at the exhaust discharge point of local exhaust system ducted to the outside of a containment (if used). If the sampling outside regulated area shows airborne fiber levels have exceeded background or 0.01 f/cc, whichever is greater, work shall be stopped immediately, and the Contracting Officer notified. The condition causing the increase shall be corrected. Work shall not restart until authorized by the CO.

3.9.7 Final Clearance Air Monitoring

The CO's IH will conduct final clearance air monitoring using aggressive air sampling techniques as defined in 40 CFR 763, Subpart E, Appendix A, Unit III, TEM Method B.7(d-f) and Table 4 of this section for all indoor asbestos abatement projects. Clearance air monitoring is not required for outside work or for soil cleanups.

3.9.7.1 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH 94-113 Method 7400, the fiber concentration inside the abated regulated area, for each airborne sample, shall be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) shall be confirmed from that

same filter using NIOSH 94-113 Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning shall be repeated. Upon completion of any required re-cleaning, re-sampling with results to meet the above clearance criteria shall be done.

3.9.7.2 Final Clearance Requirements, EPA TEM Method

For EPA TEM sampling and analysis, using the EPA Method specified in 40 CFR 763, abatement inside the regulated area is considered complete when the arithmetic mean asbestos concentration of the 5 inside samples is less than or equal to 70 structures per square millimeter (70 S/mm). When the arithmetic mean is greater than 70 S/mm, the 3 blank samples shall be analyzed. If the 3 blank samples are greater than 70 S/mm, re-sampling shall be done. If less than 70 S/mm, the 5 outside samples shall be analyzed and a Z-test analysis performed. When the Z-test results are less than 1.65, the decontamination shall be considered complete. If the Z-test results are more than 1.65, the abatement is incomplete and cleaning shall be repeated. Upon completion of any required re-cleaning, re-sampling with results to meet the above clearance criteria shall be done.

3.9.7.3 Air Clearance Failure

If clearance sampling results fail to meet the final clearance requirements, the Contractor shall pay all costs associated with the required re-cleaning, re-sampling, and analysis, until final clearance requirements are met.

3.9.8 Air-Monitoring Results and Documentation

Air sample fiber counting shall be completed and results provided within 24 hours for breathing zone samples and environmental/clearance monitoring after completion of a sampling period. The CO shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The written results shall be signed by testing laboratory analyst, testing laboratory principal and the Contractor's Designated IH or the CO's IH, depending on who performed the sampling. The air sampling results shall be documented on a Contractor's daily air monitoring log. The daily air monitoring log shall contain the following information for each sample:

a. Sampling and analytical method used;

b. Date sample collected;

c. Sample number;

d. Sample type: BZ = Breathing Zone (Personal), P = Pre-abatement, E = Environmental, C = Abatement Clearance;

e. Location/activity/name where sample collected;

f. Sampling pump manufacturer, model and serial number, beginning flow rate, end flow rate, average flow rate (L/min);

g. Calibration date, time, method, location, name of calibrator, signature;

h. Sample period (start time, stop time, elapsed time (minutes);

i. Total air volume sampled (liters);

j. Sample results (f/cc and S/mm square) if EPA methods are required for final clearance;

k. Laboratory name, location, analytical method, analyst, confidence level. In addition, the printed name and a signature and date block for the Industrial Hygienist who conducted the sampling and for the Industrial Hygienist who reviewed the daily air monitoring log verifying the accuracy of the information.

3.10 CLEARANCE CERTIFICATION

When asbestos abatement is complete, ACM waste is removed from the regulated areas, and final clean-up is completed, the CO will allow the warning signs and boundary warning tape to be removed. After final clean-up and acceptable airborne concentrations are attained, but before the HEPA unit is turned off and the containment removed, the Contractor shall remove all pre-filters on the building HVAC system and provide new pre-filters. The Contractor shall dispose of such filters as asbestos contaminated materials. HVAC, mechanical, and electrical systems shall be re-established in proper working order. The Contractor and the CO shall visually inspect all surfaces within the containment for residual material or accumulated debris. The Contractor shall reclean all areas showing dust or residual materials. The CO will certify in writing that the area is safe before unrestricted entry is permitted. The Government will have the option to perform monitoring to certify the areas are safe before entry is permitted.

3.11 CLEANUP AND DISPOSAL

3.11.1 Title to ACM Materials

ACM material resulting from abatement work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified and in accordance with applicable federal, state and local regulations.

3.11.2 Collection and Disposal of Asbestos

All ACM waste shall be collected including contaminated wastewater filters, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing and placed in leak-tight containers. Waste within the containers shall be wetted in case the container is breeched. Asbestos-containing waste shall be disposed of at an EPA, state and local approved asbestos landfill. For temporary storage, sealed impermeable containers shall be stored in an asbestos waste load-out unit or in a storage/transportation conveyance (i.e., dumpster, roll-off waste boxes, etc.) in a manner acceptable to and in an area assigned by the CO. Procedure for hauling and disposal shall comply with 40 CFR 61, Subpart M, state, regional, and local standards.

3.11.3 Scale Weight Measurement

Scales used for measurement shall be public scales. Weighing shall be at a point nearest the work at which a public scale is available. Scales shall be standard truck scales of the beam type; scales shall be equipped with the type registering beam and an "over and under" indicator; and shall be capable of accommodating the entire vehicle. Scales shall be tested, approved and sealed by an inspector of the State of Connecticut. Scales shall be calibrated and resealed as often as necessary and at least once every three months to ensure continuous accuracy. Vehicles used for hauling ACM shall be weighed empty daily at such time as directed and each vehicle shall bear a plainly legible identification mark.

3.11.4 Weight Bills and Delivery Tickets

Copies of weight bills and delivery tickets shall be submitted to the CO during the progress of the work. The Contractor shall furnish the CO scale tickets for each load of ACM weighed and certified. These tickets shall include tare weight; identification mark for each vehicle weighed; and date, time and location of loading and unloading. Tickets shall be furnished at the point and time individual trucks arrive at the worksite. A master log of all vehicle loading shall be furnished for each day of loading operations. Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified weigh bills and/or certified tickets and manifests of all ACM actually disposed by the Contractor for this contract.

3.11.5 Records and Management Plan

3.11.5.1 Asbestos Waste Shipment Records

The Contractor shall complete and provide the CO final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M and other required state waste manifest shipment records, within 3 days of delivery to the landfill. Each Waste Shipment Record shall be signed and dated by the , the waste transporter and disposal facility operator.

3.11.5.2 Asbestos Management Plan

The Contractor shall provide a summary, in electronic form, of site activities (bulk samples, asbestos removed, repaired, encased, etc.) for updating the installation Asbestos Management Plan.

TABLE 1

CONFIRMED ASBESTOS-CONTAINING MATERIALS

LOCATION	MATERIAL TYPE	ESTIMATED QUANTITY	ACM/PACM
Hall, Rms. 1145 & 1146	9″ X 9″ Green Floor Tile	940 SF	ACM
	9″ X 9″ Green Floor Tile Mastic	940 SF	ACM
Rm. 1147	12″ X 12′ White/Beige Floor Tile	90 SF	Contaminated
	12″ X 12′ White/Beige Floor Tile Mastic	90 SF	ACM
	Pipe Insulation	6 LF	ACM
	Pipe Fitting Insulation	6 Ea.	ACM
	Radiator Panel	8 SF	PACM
Rm.1148	12″ X 12′ White/Beige Floor Tile	120 SF	Contaminated
	12″ X 12′ White/Beige Floor Tile Mastic	120 SF	ACM
	Radiator Panel	18 SF	PACM
Rm. 1149	9″ X 9″ Floor Tile (Bottom Layer)	150 SF	ACM
	9″ X 9″ Floor Tile Mastic (Bottom Layer)	150 SF	ACM
	Radiator Panel	18 SF	PACM
	Radiator Panel	30 SF	PACM
Rm. 1151	12″ X 12′ White/Beige Floor Tile	145 SF	Contaminated
	12″ X 12′ White/Beige Floor Tile Mastic	145 SF	ACM
	9″ X 9″ Floor Tile (Bottom Layer)	150 SF	ACM
	9″ X 9″ Floor Tile Mastic (Bottom Layer)	150 SF	ACM
	Radiator Panel	24 SF	PACM
Rm. 1152	12″ X 12′ White/Beige Floor Tile	530 SF	Contaminated
	12″ X 12′ White/Beige Floor Tile Mastic	530 SF	ACM
	Radiator Panel	96 SF	PACM
Rm. 1155	Radiator Panel	48 SF	PACM
Rm.1160	Radiator Panel	30 SF	PACM
Rm. 1162	9″ X 9″ Brown Floor Tile	80 SF	ACM
	9″ X 9″ Brown Floor Tile Mastic	80 SF	ACM
Rm. 1174	12″ X 12′ Wood Pattern Floor Tile	300 SF	ACM
	12″ X 12′ Wood Pattern Floor Tile Mastic	300 SF	ACM
	Black Sink Coating	1 Ea	ACM
	Laboratory Table	24 SF	PACM
	Radiator Panel	24 SF	PACM

TABLE 1 (Cont.)

CONFIRMED ASBESTOS-CONTAINING MATERIALS

LOCATION	MATERIAL TYPE	ESTIMATED QUANTITY	ACM/PACM
Rm. 1175	12″ X 12′ Lt. Blue Floor Tile	420 SF	ACM
	12″ X 12′ Lt. Blue Floor Tile Mastic	420 SF	ACM

	Black Sink Coating	2 Ea	ACM
	Laboratory Table	36 SF	PACM
	Radiator Panel	70 SF	PACM
Rm. 1180	12″ X 12′ Lt. Blue Floor Tile	350 SF	ACM
	12″ X 12′ Lt. Blue Floor Tile Mastic	350 SF	ACM
	Radiator Panel	24 SF	PACM
Pathology Office	Radiator Panel	20 SF	PACM
Throughout	Pipe Insulation Above Ceiling at Perimeter Wall	NA	ACM
	Duct Pin Mastic	3,800 SF	ACM

Notes:

SF = Square Feet, EA= Each, LF= Linear Feet, NA = Not Available

Individual Work Task Data Elements are attached to this Specification Section

TABLE 2

FORMULA FOR CALCULATION OF THE 95 PERCENT CONFIDENCE LEVEL
(Reference: NIOSH 7400)

Fibers/cc(01.95 percent CL) = X + [(X) * (1.645) * (CV)]

Where: X = ((E)(AC))/((V)(1000))

E = ((F/Nf) - (B/Nb))/Af

CV = The precision value; 0.45 shall be used unless the analytical laboratory provides the Contracting Officer with documentation (Round Robin Program participation and results) that the laboratory's precision is better.

AC = Effective collection area of the filter in square millimeters

V = Air volume sampled in liters

E = Fiber density on the filter in fibers per square millimeter

F/Nf = Total fiber count per graticule field

B/Nb = Mean field blank count per graticule field

Af = Graticule field area in square millimeters

TWA = C1/T1 + C2/T2 = Cn/Tn

Where: C = Concentration of contaminant

T = Time sampled.

TABLE 3

NI0SH METHOD 7400

PCM ENVIRONMENTAL AIR SAMPLING PROTOCOL (NON-PERSONAL)

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol. (Note 2) (Liters)	Sampling Rate (liters/min.)
Inside Abatement Square Area Meters (Notes 3 & 4)	0.5/140	0.45 microns	3850	2-16
Each Room in 1 Abatement Area Less than 140 Square meters		0.45 microns	3850	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.

2. Ensure detection limit for PCM analysis is established at 0.005 fibers/cc.

3. One sample shall be added for each additional 140 square meters. (The corresponding I-P units are 5/1500 square feet).

4. A minimum of 5 samples are to be taken per abatement area, plus 2 field blanks.

TABLE 4

EPA AHERA METHOD: TEM AIR SAMPLING PROTOCOL

Location Sampled Samples	Minimum No. of	Filter Pore Size (Liters)	Min. Vol. (liters/min.)	Sampling Rate
Inside Abatement Area	5	0.45 microns	1500	2-16
Outside Abatement Area	5	0.45 microns	1500	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.

2. The detection limit for TEM analysis is 70 structures/square mm.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME _____ CONTRACT NO. _____

PROJECT ADDRESS _____

CONTRACTOR FIRM NAME _____

EMPLOYEE'S NAME _____
(Print) (Last) (First) (MI)

Social Security Number: _____-_____-_____,__(Optional)

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH TYPES OF LUNG DISEASE AND CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract for the above project requires that you be provided and you complete formal asbestos training specific to the type of work you will perform and project specific training; that you be supplied with proper personal protective equipment including a respirator, that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you. The Contractor's Designated Industrial Hygienist will check the block(s) for the type of formal training you have completed. Review the checked blocks prior to signing this certification.

FORMAL TRAINING:

_____a. For Competent Persons and Supervisors: I have completed EPA's Model Accreditation Program (MAP) training course, "Contractor/Supervisor", that meets this State's requirements.

b. For Workers:

_____ (1) For OSHA Class I work: I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (2) For OSHA Class II work (where there will be abatement of more than one type of Class II materials, i.e., roofing, siding, floor tile, etc.): I have completed EPA's MAP training course, "Worker",that meets this State's requirements.

(3) For OSHA Class II work (there will only be abatement of one type of Class II material):

_____ (a) I have completed an 8-hour training class on the elements of 29 CFR 1926.1101(k)(9)(viii), in addition to the specific work practices and engineering controls of 29 CFR 1926.1101(g) and hands-on training.

_____ (b) I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (4) For OSHA Class III work: I have completed at least a 16-hour course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763,

Section .92(a)(2) and the elements of 29 CFR 1926.1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926.1101, and hands-on training.

_____ (5) For OSHA Class IV work: I have completed at least a 2-hr course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, (a)(1), and the elements of 29 CFR 1926.1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926.1101(g) and hands-on training.

_____ c. Workers, Supervisors and the Designated Competent Person: I have completed annual refresher training as required by EPA's MAP that meets this State's requirements.

PROJECT SPECIFIC TRAINING:
_____ I have been provided and have completed the project specific training required by this Contract. My employer's Designated Industrial Hygienist and Designated Competent Person conducted the training.

RESPIRATORY PROTECTION:
_____ I have been trained in accordance with the criteria in the Contractor's Respiratory Protection program. I have been trained in the dangers of handling and breathing asbestos dust and in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair and contact lens use policy of my employer.

RESPIRATOR FIT-TEST TRAINING:
_____ I have been trained in the proper selection, fit, use, care, cleaning, maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time.

EPA/STATE of CONNECTICUT CERTIFICATION/LICENSE

I have an EPA/State of Connecticut certification/license as:
_____Building Inspector/Management Planner; Certification #_____
_____Contractor/Supervisor, Certification #_____
_____Project Designer, Certification #_____
_____Worker, Certification #_____

MEDICAL EXAMINATION:

_____ I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing personal protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's Industrial Hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

_____ were no limitations to performing the required work tasks.

_____ were identified physical limitations to performing the required work tasks.

Date of the medical examination _____

Employee Signature _____ Date _____

Contractor's Industrial
Hygienist Signature _____ Date _____

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet___1__ of ___6__

1. WORK TASK DESIGNATION NUMBER ____1___

2. LOCATION OF WORK Rooms 1145,1146, 1147,1148, 1149, 1151, 1152, 1155, 1160, 1162, 1174, 1175, 1180

TASK 1_____

3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED: Floor Tile & Floor Tile Mastic
_____

a. Type of Asbestos _Crysotile_____
b. Percent asbestos content _2 - 5_____%

4. ABATEMENT TECHNIQUE TO BE USED
_Removal_____

5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK Class II___

6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
Friable _____ Non-friable Category I _____
Non-friable Category II___X__

7. FORM _____ and CONDITION OF ACM: GOOD__X___ FAIR_____POOR_____

8. QUANTITY: METERS_____, SQUARE METERS_____
8a. QUANTITY: LINEAR FT._____, SQUARE FT.___3,275_____

9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK 59_____

10. SET-UP DETAIL SHEET NUMBERS

FOR WORK TASK _1_, _4__, _8_, _22_,_23_, ____, ____, ___.

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet__2__ of __6__

1. WORK TASK DESIGNATION NUMBER __2___

2. LOCATION OF WORK Room 1147 and Throughout
TASK_2_____

3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED:_Pipe & Pipe Fitting Insulation
   a. Type of Asbestos _Crysotile_____
   b. Percent asbestos content _15 - 30%

4. ABATEMENT TECHNIQUE TO BE USED_Removal_____

5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK Class I_____

6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
   Friable ___X__ Non-friable Category I _
   Non-friable Category II_

7. FORM _____ and CONDITION OF ACM: GOOD_X___ FAIR_____ POOR_____

8. QUANTITY: METERS_____, SQUARE METERS_____

8a. QUANTITY: LINEAR FT.____NA_____, SQUARE FT._____

9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK 59, 89 or 94

10. SET-UP DETAIL SHEET NUMBERS
    FOR WORK TASK _4, _8, _10, ____, ____, ____, ___, ___.

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet___3__ of __6___

1. WORK TASK DESIGNATION NUMBER _3_
2. LOCATION OF WORK Rooms 1147, 1148, 1149, 1151, 1152, 1155, 1160, 1174, 1175,1180 and Pathology OfficeTASK_3_

3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED:_Radiator Panel
   a. Type of Asbestos _PACM_
   b. Percent asbestos content _N/A_%

4. ABATEMENT TECHNIQUE TO BE USED Removal_____

5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK Class II___

6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
   Friable _____ Non-friable Category I
   Non-friable Category II___X__

7. FORM _____ and CONDITION OF ACM: GOOD__X___ FAIR_____ POOR_____

8. QUANTITY: METERS_____, SQUARE METERS_____

8a. QUANTITY: LINEAR FT.____410_____, SQUARE FT._____

9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK 59 or 48_

10. SET-UP DETAIL SHEET NUMBERS FOR WORK TASK _1, _4_, _8_, or 21.

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet___4__ of ___6__

1. WORK TASK DESIGNATION NUMBER _4_

2. LOCATION OF WORK Throughout Office TASK_4_____

3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED:_Duct Mastic

   a. Type of Asbestos _Chrysotile__
   b. Percent asbestos content _10_%

4. ABATEMENT TECHNIQUE TO BE USED _Removal_____

5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK Class II____

6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
   Friable _____ Non-friable Category _I _
   Non-friable Category II__X__

7. FORM _____ and CONDITION OF ACM: GOOD__X___ FAIR_____ POOR_____

8. QUANTITY: METERS_____, SQUARE METERS_____

8a. QUANTITY: LINEAR FT._____, SQUARE FT._3,800_____

9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK _101__

10. SET-UP DETAIL SHEET NUMBERS FOR WORK TASK 1_, _4_, _8_.

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet_5__ of _6__

1. WORK TASK DESIGNATION NUMBER _5__

2. LOCATION OF WORK Rooms 1174 & 1175 Office TASK_____

3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED:_Black Sink Coating

   a. Type of Asbestos _Chrysotile____
   b. Percent asbestos content _2%

4. ABATEMENT TECHNIQUE TO BE USED _Removal_____

5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK Class II_____

6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
   Friable _____ Non-friable Category I _
   Non-friable Category II _X__

7. FORM _____ and CONDITION OF ACM: GOOD__X___ FAIR_____ POOR_____

8. QUANTITY: METERS_____, SQUARE METERS_____

8a. QUANTITY: LINEAR FT._____, SQUARE FT._____EACH 3

9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK _____45_____

10. SET-UP DETAIL SHEET NUMBERS FOR WORK TASK 11, 21_.

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet_6__ of _6__

1. WORK TASK DESIGNATION NUMBER __6_

2. LOCATION OF WORK Rooms 1175 OfficeTASK_3__

3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED:_Lab Top

   a. Type of Asbestos _PACM_____
   b. Percent asbestos content _N/A_%

4. ABATEMENT TECHNIQUE TO BE USED Removal_____

5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK Class II__

6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK
   Friable _____ Non-friable Category I
   Non-friable Category II_X__

7. FORM _____ and CONDITION OF ACM: GOOD__X___ FAIR_____ POOR_____

8. QUANTITY: METERS_____, SQUARE METERS_____

8a. QUANTITY: LINEAR FT._____, SQUARE FT.__36_

9. RESPONSE ACTION DETAIL SHEET NUMBER FOR WORK TASK _45_

10. SET-UP DETAIL SHEET NUMBERS FOR WORK TASK _11_, _21_.

SECTION 02 82 16
ENGINEERING CONTROL OF ASBESTOS CONTAINING MATERIALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z88.2 (1992) Respiratory Protection

ANSI Z9.2 (2001) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASTM INTERNATIONAL (ASTM)

ASTM C 732 (2006) Aging Effects of Artificial Weathering on Latex Sealants

ASTM D 1331 (1989; R 2001) Surface and Interfacial Tension of Solutions of Surface-Active Agents

ASTM D 2794 (1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

ASTM D 522 (1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings

ASTM E 119 (2007a) Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E 1368 (2005e1) Visual Inspection of Asbestos Abatement Projects

ASTM E 1494 (1992; R 2002) Encapsulants for Spray- or Trowel-Applied Friable Asbestos-Containing Building Materials

ASTM E 736 (2000; R 2006) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

ASTM E 84 (2007b) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E 96/E 96M (2005) Standard Test Methods for Water Vapor Transmission of Materials

STATE OF CONNECTICUT, DEPARTMENT OF PUBLIC HEATH ADMINISTRATIVE REGULATIONS

16 VAC 25-20-30 Title 16, Agency 25, Chapter 20, Section 30: Notification and Permit Fee

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 560/5-85-024 (1985) Guidance for Controlling Asbestos-Containing Materials in Buildings (Purple Book)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.103 Respiratory Protection

29 CFR 1926.1101 Asbestos

29 CFR 1926.200 Accident Prevention Signs and Tags

29 CFR 1926.51 Sanitation

29 CFR 1926.59 Hazard Communication

40 CFR 61-SUBPART A General Provisions

40 CFR 61-SUBPART M National Emission Standard for Asbestos

40 CFR 763 Asbestos

UNDERWRITERS LABORATORIES (UL)

UL 586(1996; Rev thru Aug 2004) Standard for High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 ACM

Asbestos-Containing Materials.

1.2.2 Amended Water

Water containing a wetting agent or surfactant with a maximum surface tension of 29 dynes per centimeter when tested in accordance with ASTM D 1331.

1.2.3 Area Sampling

Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.

1.2.4 Asbestos

The term asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered. Materials are considered to contain asbestos if the asbestos content of the material is determined to be at least one percent.

1.2.5 Asbestos Control Area

That area where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of the uncontrolled release of asbestos dust, fibers, or debris.

1.2.6 Asbestos Fibers

Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.

1.2.7 Asbestos Permissible Exposure Limit

0.1 fibers per cubic centimeter of air as an 8-hour time weighted average measured in the breathing zone as defined by 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.

1.2.8 Background

The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for other (contaminated) areas are measured in similar but asbestos free locations.

1.2.9 Contractor

The Contractor is that individual, or entity under contract to the Veterans Administration to perform the herein listed work.

1.2.10 Competent Person

A person meeting the requirements for competent person as specified in 29 CFR 1926.1101 including a person capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, and is specifically trained in a training course which meet the criteria of EPA's Model Accreditation Plan (40 CFR 763) for project designer or supervisor, or its equivalent. The competent person shall have a current State of Connecticut asbestos contractors or supervisors license.]

1.2.11 Encapsulation

The abatement of an asbestos hazard through the appropriate use of chemical encapsulants.

1.2.12 Encapsulants

Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.

A. Removal Encapsulant (can be used as a wetting agent)

B. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)

C. Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)

D. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).

1.2.13 Friable Asbestos Material

One percent asbestos containing material that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

1.2.14 Glovebag Technique

Those asbestos removal and control techniques put forth in 29 CFR 1926.1101 Appendix G.

1.2.15 HEPA Filter Equipment

High efficiency particulate air (HEPA) filtered vacuum and/or exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.

1.2.16 Contracting Officer’s Industrial Hygienist (COIH)

That qualified person employed directly by the Government to monitor, sample, inspect the work or in some other way advise the Contracting Officer. The COIH is normally a private consultant, but can be an employee of the Government.

1.2.17 Negative Pressure Enclosure (NPE)

That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101.

1.2.18 Nonfriable Asbestos Material

Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, removal, or mishap.

1.2.19 Personal Sampling

Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.

1.2.20 Private Qualified Person (PQP)

That qualified person hired by the Contractor to perform the herein listed tasks.

1.2.21 Qualified Person (QP)

A Registered Architect, Professional Engineer, Certified Industrial Hygienist, consultant or other qualified person who has successfully completed training and is therefore accredited under a legitimate State Model Accreditation Plan as described in 40 CFR 763 as a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer; and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent. The QP must be qualified to perform visual inspections as indicated in ASTM E 1368. The QP shall be appropriately licensed in the State of Connecticut.

1.2.22 TEM

Refers to Transmission Electron Microscopy.

1.2.23 Time Weighted Average (TWA)

The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.

1.2.24 Wetting Agent

A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 29 dynes per centimeter when tested in accordance with ASTM D 1331.

1.3 REQUIREMENTS

1.3.1 Description of Work

The work covered by this section includes the handling and control of asbestos containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos containing materials generated by the work. More specific operational procedures shall be outlined in the Asbestos Hazard Abatement Plan called for elsewhere in this specification. The asbestos work includes the removal of ACM located in the Pathology Area on the first floor of Building 1,which is governed by 40 CFR 763. [Under normal conditions non-friable or chemically bound materials containing asbestos would not be considered hazardous; however, this material may release airborne asbestos fibers during demolition and removal and therefore must be handled in accordance with the removal and disposal procedures as specified herein. Provide negative pressure enclosure techniques as outlined in this specification. The VA will evacuate the work area] during the asbestos abatement work. All asbestos removal work shall be supervised by a competent person as specified herein.

1.3.1.1 Wallboard/Joint Compound

Discrete samples of the wallboard were tested and found to contain less than one percent asbestos.

1.3.2 Medical Requirements

Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.

1.3.2.1 Medical Examinations

Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101 or other pertinent State or local directives. This requirement must have been satisfied within the 12 months prior to the start of work on this contract. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS."

1.3.2.2 Medical Records

Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of 50 years after termination of employment and make records of the required medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.

1.3.3 Employee Training

Submit certificates, prior to the start of work but after the main abatement submittal, signed by each employee indicating that the employee has received training in the proper handling of materials and wastes that contain asbestos in accordance with 40 CFR 763; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment as indicated in 29 CFR 1926.1101 on an initial and annual basis. Certificates shall be organized by individual worker, not grouped by type of certification. Train all personnel involved in the asbestos control work in accordance with United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria or State training criteria whichever is more stringent. The Contractor shall document the training by providing: dates of training, training entity, course outline, names of instructors, and qualifications of instructors upon request by the Contracting Officer. Furnish each employee with respirator training and fit testing administered by the PQP as required by 29 CFR 1926.1101. Fully cover engineering and other hazard control techniques and procedures. All asbestos workers shall have a current State of Connecticut asbestos worker's license.]

1.3.4 Permits, Licenses, and Notifications

Obtain necessary permits and licenses in conjunction with asbestos removal, encapsulation, hauling, and disposition, and furnish notification of such actions required by Federal, State, regional, and local authorities prior to the start of work. Notify the Regional Office of the United States

Environmental Protection Agency (USEPA) Connecticut Department of Public Health and the Contracting Officer in writing 10 working days prior to commencement of work in accordance with 40 CFR 61-SUBPART M. Notify the Contracting Officer and other appropriate Government agencies in writing 10 working days prior to the start of asbestos work as indicated in applicable laws, ordinances, criteria, rules, and regulations. Submit copies of all Notifications to the Contracting Officer.

1.3.5 Environment, Safety and Health Compliance

In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of Federal, State, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.1101, 40 CFR 61-SUBPART A, 40 CFR 61-SUBPART M, and ND OPNAVINST 5100.23. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Government shall apply. The following laws, ordinances, criteria, rules and regulations regarding removal, handling, storing, transporting and disposing of asbestos materials apply:

a. U.S. Environmental Protection Agency (USEPA) National Emissions Standards for Hazardous Air Pollutants (NESHAP) Regulations (40 CFR 61, Subpart M);
b. U.S. Occupational Safety and Health Administration (OSHA) Asbestos Regulations (29 CFR 1910.1001 and 1926.1101);
c. State of Connecticut Department of Public Health (CTDPH) Standards for Asbestos Abatement Sections 19a-332a-1 through 19a-332a-16 inclusive and Sections 20-440-1 through 20-440-9 inclusive;
d CTDPH Asbestos-Containing Materials in Schools Regulations 19a-333-1 through 19a-333-13;
e. State of Connecticut Department of Environmental Protection (CTDEP) Regulations, Section 22a-209-8(i) and Section 22a-220 of the Connecticut General Statute.

1.3.6 Respiratory Protection Program

Establish and implement a respirator program as required by ANSI Z88.2, 29 CFR 1926.1101, and 29 CFR 1926.103. Submit a written description of the program to the Contracting Officer. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.

1.3.6.1 Respirator Program Records

Submit records of the respirator program as required by ANSI Z88.2, 29 CFR 1926.103, and 29 CFR 1926.1101.

1.3.7 Asbestos Hazard Control Supervisor

The Contractor shall be represented on site by a supervisor, trained using the model Contractor accreditation plan as indicated in the Federal statutes for all portions of the herein listed work.

1.3.8 Hazard Communication

Adhere to all parts of 29 CFR 1926.59 and provide the Contracting Officer with a copy of the Material Safety Data Sheets (MSDS) for all materials brought to the site.

1.3.9 Asbestos Hazard Abatement Plan

Submit a detailed plan of the safety precautions such as lockout, tagout, tryout, fall protection, and confined space entry procedures and equipment and work procedures to be used in the removal of materials containing asbestos. The plan, not to be combined with other hazard abatement plans, shall be prepared, signed, and sealed by the PQP. Provide a Table of Contents for each abatement submittal, which shall follow the sequence of requirements in the contract. Such plan shall include but not be limited to the precise personal protective equipment to be used including, but not limited to, respiratory protection, type of whole-body protection [and if reusable coveralls are to be employed decontamination methods (operations and quality control plan)], the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, locations of local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan shall also include (both fire and medical emergency) response plans. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work. The Contractor, Asbestos Hazard Control Supervisor, and PQP shall meet with the Contracting Officer prior to beginning work, to discuss in detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Contracting Officer, the plan will be enforced as if an addition to the specification. Any changes required in the specification as a result of the plan shall be identified specifically in the plan to allow for free discussion and approval by the Contracting Officer prior to starting work.

1.3.10 Testing Laboratory

Submit the name, address, and telephone number of each testing laboratory selected for the sampling, analysis, and reporting of airborne concentrations of asbestos fibers along with [evidence that each laboratory selected holds the appropriate State license and/or permits and] certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis. The testing laboratory firm shall be independent of the asbestos contractor and shall have no employee or employer relationship which could constitute a conflict of interest.

1.3.11 Landfill Approval

Submit written evidence that the landfill is for asbestos disposal by the U.S. Environmental Protection Agency, Region 1, Air Enforcement Section (38W12), and local regulatory agencies. Within 3 working days after delivery, submit detailed delivery tickets, prepared, signed, and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill. Submit a copy of the waste shipment records within 1 day of the shipment leaving the project site.

1.3.12 Medical Certification

Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1926.103 as prescribed by law. Submit certificates prior to the start of work but after the main abatement submittal.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Local exhaust equipment; G COIH

Vacuums; G COIH

Respirators; G COIH

Pressure differential automatic recording instrument; G COIH

Amended water; G COIH

Glovebags; G COIH

Material Safety Data Sheets (MSDS) for all materials proposed for transport to the project site; G COIH

Encapsulants; G COIH

SD-06 Test Reports

Air sampling results; G COIH

Pressure differential recordings for local exhaust system; G COIH

Asbestos disposal quantity report; G COIH

Encapsulation test patches; G COIH

Clearance sampling; G COIH

SD-07 Certificates

Asbestos hazard abatement plan; G COIH

Testing laboratory; G COIH

Private qualified person documentation; G COIH

Contractor's license; G COIH

Competent person documentation; G COIH

Worker's license; G COIH

Landfill approval; G COIH

Employee training; G COIH

Medical certification requirements; G COIH

Waste shipment records and if applicable exemption report; G COIH

Respiratory Protection Program; G COIH

Delivery tickets; G COIH

Vacuums; G COIH

Water filtration equipment; G COIH

Ventilation systems; G COIH

Other equipment used to contain airborne asbestos fibers; G COIH

Chemical encapsulants sealers; G COIH

Notifications

Show compliance with ANSI Z9.2 by providing manufacturers' certifications.

SD-11 Closeout Submittals

Notifications; G COIH

Rental equipment; G COIH

Respirator program records; G COIH

Permits and licenses; G COIH

1.5 QUALITY ASSURANCE

1.5.1 Private Qualified Person Documentation

Submit the name, address, and telephone number of the Private Qualified Person (PQP) selected to prepare the Asbestos Hazard Abatement Plan, direct monitoring and training, and documented evidence that the PQP has successfully completed training in and is accredited and where required is certified as, a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer as described by 40 CFR 763 and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent. The PQP shall be appropriately licensed in the State of Connecticut as a Project Monitor. The PQP and the asbestos contractor shall not have an employee/employer relationship or financial relationship which could constitute a conflict of interest. The PQP shall be a first tier subcontractor.

1.5.2 Competent Person Documentation

Submit training certification and a current State of Connecticut Asbestos Contractor's and Supervisor's License.

1.5.3 Worker's License

Submit documentation that requires all workers have a current State of Connecticut Asbestos Workers License.

1.5.4 Contractor's License

Contractor shall have current State of Connecticut asbestos contractor's license. Submit a copy of the asbestos contractor's license issued by the State of Connecticut.

1.5.5 Air Sampling Results

Complete fiber counting and provide results to the COIH for review within 16 hours of the "time off" of the sample pump. Notify the Contracting Officer immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Submit sampling results to the Contracting Officer and the affected Contractor employees where required by law within 3 working days, signed by the testing laboratory employee performing air sampling, the employee that analyzed the sample, and the PQP. Notify the Contractor and the Contracting Officer immediately of any variance in the pressure differential which could cause adjacent unsealed areas to have asbestos fiber concentrations in excess of 0.01 fibers per cubic centimeter or background whichever is higher. In no circumstance shall levels exceed 0.1 fibers per cubic centimeter.

1.5.6 Pressure Differential Recordings for Local Exhaust System

Provide a local exhaust system that creates a negative pressure of at least 0.02 inches of water relative to the pressure external to the enclosure and operate it continuously, 24 hours a day, until the temporary enclosure of the asbestos control area is removed. Submit pressure differential recordings for each work day to the COIH for review and to the Contracting Officer within 24 hours from the end of each work day.

1.5.7 Protective Clothing Decontamination Quality Control Records

Provide all records that document quality control for the decontamination of reusable outer protective clothing.

1.5.8 Protective Clothing Decontamination Facility Notification

Submit written evidence that persons who decontaminate, store, or transport asbestos contaminated clothing used in the performance of this contract were duly notified in accordance with 29 CFR 1926.1101.

1.6 EQUIPMENT

1.6.1 Rental Equipment

Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

PART 2 PRODUCTS

2.1 ENCAPSULANTS

Shall conform to current USEPA requirements, shall contain no toxic or hazardous substances as defined in 29 CFR 1926.59, and shall conform to the following performance requirements.

2.1.1 Removal Encapsulants

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E 84
Life Expectancy - 20 years	ASTM C 732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E 96/E 96M

2.1.2 Bridging Encapsulant

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E 84
Life Expectancy - 20 years	ASTM C 732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E 96/E 96M
Fire Resistance - Negligible affect on rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E 119 fire resistance
Impact Resistance - Minimum	ASTM D 2794 43 in/lb Gardner Impact Test

Flexibility - no rupture or cracking ASTM D 522 Mandrel Bend Test

2.1.3 Penetrating Encapsulant

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E 84
Life Expectancy - 20 years	ASTM C 732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E 96/E 96M
Cohesion/Adhesion Test -	ASTM E 736 50 pounds of force/foot
Fire Resistance - Negligible affect on ASTM E 119 fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	
Impact Resistance - Minimum	ASTM D 2794 43 in/lb Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D 522 Mandrel Bend Test

2.1.4 Lock-down Encapsulant

Requirement	Test Standard
Flame Spread: 25, Smoke Emission - 50	ASTM E 84
Life Expectancy: 20 years	ASTM C 732 Accelerated Aging Test
Permeability: Minimum 0.4 perms	ASTM E 96/E 96M
Fire Resistance: Negligible affect on ASTM E 119 fire resistance rating over 3 hour test (Tested with fireproofing over encapsulant applied directly to steel member)	
Bond Strength: 100 pounds of force/foot	ASTM E 736 (Tests compatibility with cementitious and fibrous fireproofing)

PART 3 EXECUTION

3.1 EQUIPMENT

At all times, provide the Contracting Officer or the Contracting Officer's Representative, with at least two complete sets of personal protective equipment [including decontaminating reusable coveralls] as required for entry to and inspection of the asbestos control area. Provide equivalent training to the Contracting Officer or a designated representative as provided to Contractor employees in the use of the required personal protective equipment. Provide manufacturer's certificate of compliance for all equipment used to contain airborne asbestos fibers.

3.1.1 Respirators

Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

3.1.1.1 Respirators for Handling Asbestos

Provide personnel engaged in pre-cleaning, cleanup, handling and removal of asbestos materials with respiratory protection as indicated in 29 CFR 1926.1101 and 29 CFR 1926.103.

3.1.2 Exterior Whole Body Protection

3.1.2.1 Outer Protective Clothing

Provide personnel exposed to asbestos with disposable "non-breathable," whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape. Reusable whole body outer protective clothing shall be either disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area or be properly decontaminated.

3.1.2.2 Work Clothing

Provide cloth work clothes for wear under the outer protective clothing and foot coverings and either dispose of or properly decontaminate them as recommended by the PQP after each use.

3.1.2.3 Personal Decontamination Unit

Provide a temporary, negative pressure unit with a separate decontamination locker room and clean locker room with a shower that complies with 29 CFR 1926.51(f)(4)(ii) through (V) in between for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal. HEPA vacuum and remove asbestos contaminated reusable protective clothing while still wearing respirators at the boundary of the asbestos work area, seal in two impermeable bags, label outer bag as asbestos contaminated waste, and transport for decontamination. Do not wear work clothing between home and work. Locate showers between the decontamination locker room and the clean locker room and require that all employees shower before changing into street clothes. Collect used shower water and filter with approved water filtration equipment to remove asbestos contamination. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste. Decontamination units shall be physically attached to the asbestos control area. Build both a personnel decontamination unit and an equipment decontamination unit onto and integral with each asbestos control area.

3.1.2.4 Decontamination of Reusable Outer Protective Clothing

When reusable outer protective clothing is used, transport the double bagged clothing to a previously notified commercial/industrial decontamination facility for decontamination. Perform non-destructive testing to determine the effectiveness of asbestos decontamination. If representative sampling is used, ensure the statistical validity of the sampling results. If representative sampling is used, reject any entire batch in which any of the pieces exceed 40 fibers per square millimeter. Inspect reusable protective clothing prior to use to ensure that it will provide adequate protection and is not or is not about to become ripped, torn, deteriorated, or damaged, and that it is not visibly contaminated. Notify, in writing, all personnel involved in the decontamination of reusable outer protective clothing as indicated in 29 CFR 1926.1101.

3.1.2.5 Eye Protection

Provide goggles to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.

3.1.3 Warning Signs and Labels

Provide bilingual warning signs printed in English and Spanish at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.

3.1.3.1 Warning Sign

Provide vertical format conforming to 29 CFR 1926.200, and 29 CFR 1926.1101 minimum 20 by 14 inches displaying the following legend in the lower panel:

Legend	Notation
Danger	one inch Sans Serif, Gothic or Block
Asbestos	one inch Sans Serif, Gothic or Block
Cancer and Lung Disease Hazard	1/4 inch Sans Serif, Gothic or Block
Authorized Personnel Only	1/4 inch Gothic
Respirators and Protective	1/4 inch Gothic

Clothing are Required in this Area

Spacing between lines shall be at least equal to the height of the upper of any two lines.

3.1.3.2 Warning Labels

Provide labels conforming to 29 CFR 1926.1101 of sufficient size to be clearly legible, displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM

3.1.4 Local Exhaust System

Provide a local exhaust system in the asbestos control area in accordance with ANSI Z9.2 and 29 CFR 1926.1101 that will provide at least four air changes per hour inside of the negative pressure enclosure. Local exhaust equipment shall be operated 24 hours per day, until the asbestos control area is removed and shall be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the control area of minus 0.02 inch of water column relative to adjacent, unsealed areas. Provide continuous 24-hour per day monitoring of the pressure differential with a pressure differential automatic recording instrument. In no case shall the building ventilation system be used as the local exhaust system for the asbestos control area. Filters on exhaust equipment shall conform to ANSI Z9.2 and UL 586. The local exhaust system shall terminate out of doors and remote from any public access or ventilation system intakes.

3.1.5 Tools

Vacuums shall be leak proof to the filter and equipped with HEPA filters. Filters on vacuums shall conform to ANSI Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse.

3.1.6 Rental Equipment

If rental equipment is to be used, furnish written notification to the rental agency concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

3.1.7 Glovebags

Submit written manufacturers proof that glovebags will not break down under expected temperatures and conditions.

3.2 WORK PROCEDURE

Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, and as specified herein. Use wet removal procedures as listed in the asbestos hazard abatement plan and negative pressure enclosure techniques. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, chewing gum, tobacco, or applying cosmetics shall not be permitted in the asbestos work or control areas. Personnel of other trades not engaged in the removal and demolition of asbestos containing material shall not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection and training provisions of this specification are complied with by the trade personnel. Shut down the building heating, ventilating, and air conditioning system, cap the openings to the system, prior to the commencement of asbestos work. Disconnect electrical service when wet

removal is performed and provide temporary electrical service with verifiable ground fault circuit interrupter (GFCI) protection prior to the use of any water If an asbestos fiber release or spill occurs outside of the asbestos control area, stop work immediately, correct the condition to the satisfaction of the Contracting Officer including clearance sampling, prior to resumption of work.

3.2.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent work. Where such work is damaged or contaminated as verified by the Contracting Officer using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained from the COIH work may proceed at the discretion of the Contracting Officer.

3.2.2 Furnishings

Furniture and equipment will be removed from the area of work by the Government before asbestos work begins.

3.2.3 Pre-cleaning

Wet wipe and HEPA vacuum all surfaces potentially contaminated with asbestos prior to establishment of an enclosure.

3.2.4 Asbestos Control Area Requirements

3.2.4.1 Negative Pressure Enclosure

Block and seal openings in areas where the release of airborne asbestos fibers can be expected. Establish an asbestos negative pressure enclosure with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area. Negative pressure enclosure development shall include protective covering of uncontaminated walls, and ceilings with a continuous membrane of two layers of minimum 6-mil plastic sheet sealed with tape to prevent water or other damage. Provide two layers of 6-mil plastic sheet over floors and extend a minimum of 12 inches up walls. Seal all joints with tape. Provide local exhaust system in the asbestos control area. Openings will be allowed in enclosures of asbestos control areas for personnel and equipment entry and exit, the supply and exhaust of air for the local exhaust system and the removal of properly containerized asbestos containing materials. Replace local exhaust system filters as required to maintain the efficiency of the system.

3.2.4.2 Glovebag

The construction of a negative pressure enclosure is infeasible for the removal of pipe and pipe fitting insulation located in the work area. Use alternate techniques as indicated in 29 CFR 1926.1101. Establish designated limits for the asbestos regulated area with the use of rope or other

continuous barriers, and maintain all other requirements for asbestos control areas. The PQP shall conduct personal samples of each worker engaged in asbestos handling (removal, disposal, transport and other associated work) throughout the duration of the project. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers at any time exceeds background or 0.01 fibers per cubic centimeter whichever is greater, stop work, evacuate personnel in adjacent areas or provide personnel with approved protective equipment at the discretion of the Contracting Officer. This sampling may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those obtained by the Contractor, the Government will determine which results predominate. If adjacent areas are contaminated as determined by the Contracting Officer, clean the contaminated areas, monitor, and visually inspect the area as specified herein.

3.2.5 Removal Procedures

Wet asbestos material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 6 mil plastic disposal bags. Remove asbestos containing material in a gradual manner, with continuous application of the amended water or wetting agent in such a manner that no asbestos material is disturbed prior to being adequately wetted. Where unusual circumstances prohibit the use of 6 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Contracting Officer for approval. For example, in the case where both piping and insulation are to be removed, the Contractor may elect to wet the insulation, wrap the pipes and insulation in plastic and remove the pipe by sections. Asbestos containing material shall be containerized while wet. At no time shall asbestos material be allowed to accumulate or become dry. Lower and otherwise handle asbestos containing material as indicated in 40 CFR 61-SUBPART M.

3.2.5.1 Sealing Contaminated Items Designated for Disposal

Remove contaminated architectural, mechanical, and electrical appurtenances such as venetian blinds, full-height partitions, carpeting, duct work, pipes and fittings, radiators, light fixtures, conduit, panels, and other contaminated items designated for removal by completely coating the items with an asbestos lock-down encapsulant at the demolition site before removing the items from the asbestos control area. These items need not be vacuumed. The asbestos lock-down encapsulant shall be tinted a contrasting color. It shall be spray-applied by airless method. Thoroughness of sealing operation shall be visually gauged by the extent of colored coating on exposed surfaces. Lock-down encapsulants shall comply with the performance requirements specified herein.

3.2.5.2 Exposed Pipe Insulation Edges

Contain edges of asbestos insulation to remain that are exposed by a removal operation. Wet and cut the rough ends true and square with sharp tools and then encapsulate the edges with a 1/4 inch thick layer of non-asbestos containing insulating cement troweled to a smooth hard finish. When cement is dry, lag the end with a layer of non-asbestos lagging cloth, overlapping the existing ends by at least 4 inches. When insulating cement and cloth is

an impractical method of sealing a raw edge of asbestos, take appropriate steps to seal the raw edges as approved by the Contracting Officer.

3.2.6 Encapsulation Procedures

3.2.6.1 Large-Scale Application

Apply encapsulant using an airless sprayer at the lowest pressure and as recommended by the encapsulant manufacturer. Follow exactly the manufacturer's instructions for thinning recommendations, application procedures and rates. Keep the encapsulant material stirred to prevent settling. Keep a clean work area. Change pre-filters in the ventilation equipment as soon as they appear clogged by encapsulant aerosol or pressure differential drops below 0.02 Hg.

3.2.7 Air Sampling

Sampling of airborne concentrations of asbestos fibers shall be performed in accordance with 29 CFR 1926.1101 and as specified herein. Sampling performed in accordance with 29 CFR 1926.1101 shall be performed by the PQP. Sampling performed for environmental and quality control reasons shall be performed by the PQP and /or the COIH Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government will determine which results predominate.

3.2.7.1 Sampling Prior to Asbestos Work

Provide area air sampling and establish the baseline one day prior to the masking and sealing operations for each removal site. Establish the background by performing area sampling in similar but uncontaminated sites in the building.

3.2.7.2 Sampling During Asbestos Work

The PQP shall provide personal and area sampling as indicated in 29 CFR 1926.1101 and governing environmental regulations. In addition, provided the same type of work is being performed, provide area sampling at least once every work shift close to the work inside the enclosure, outside the clean room entrance to the enclosure, and at the exhaust opening of the local exhaust system. If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the increase, and notify the Contracting Officer immediately. Where alternate methods are used, perform personal and area air sampling at locations and frequencies that will accurately characterize the evolving airborne asbestos levels.

The PQP shall provide personal sampling as indicated in 29 CFR 1926.1101. At the same time the COIH will provide area sampling close to the work inside the enclosure, outside the clean room entrance to the enclosure, and at the exhaust opening of the local exhaust system. In addition, provided the same type of work is being performed, the COIH will provide area sampling once every work shift close to the work inside the enclosure, outside the clean room entrance to the enclosure, and at the exhaust opening of the local exhaust system. If sampling outside the enclosure shows airborne levels have

exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the increase, and notify the Contracting Officer immediately. Where alternate methods are used, perform personal and area air sampling at locations and frequencies that will accurately characterize the evolving airborne asbestos levels.

3.2.7.3 Sampling After Final Clean-Up (Clearance Sampling)

Provide area sampling of asbestos fibers using aggressive air sampling techniques as defined in the EPA 560/5-85-024 and establish an airborne asbestos concentration of less than 0.01 fibers per cubic centimeter after final clean-up but before removal of the enclosure or the asbestos work control area. After final cleanup and the asbestos control area is dry but prior to clearance sampling, the PQP and COIH shall perform a visual inspection in accordance with ASTM E 1368 to ensure that the asbestos control and work area is free of any accumulations of dirt, dust, or debris. Prepare a written report signed and dated by the PQP documenting that the asbestos control area is free of dust, dirt, and debris and all waste has been removed. If required by State of Connecticut regulations, use transmission electron microscopy (TEM) to analyze clearance samples and report the results in accordance with current AHERA criteria. The asbestos fiber counts from these samples shall be less than 70 structures per millimeter squared or be not greater than the background, whichever is greater. Should any of the final samples indicate a higher value, the Contractor shall take appropriate actions to re-clean the area
and shall repeat the sampling and TEM analysis at the Contractor's expense.

3.2.8 Lock-Down

Prior to removal of plastic barriers and after pre-clearance clean up of gross contamination, the PQP and the COIH shall conduct a visual inspection of all areas affected by the removal in accordance with ASTM E 1368. Inspect for any visible fibers. A post removal (lock-down) encapsulant shall then be spray applied to ceiling, walls, floors and other areas exposed in the removal area. The exposed area shall include but not be limited to plastic barriers and articles to be discarded as well as dirty change room, air locks for bag removal and decontamination chambers.

3.2.9 Site Inspection

While performing asbestos engineering control work, the Contractor shall be subject to on-site inspection by the Contracting Officer who may be assisted by or represented by safety or industrial hygiene personnel. If the work is found to be in violation of this specification, the Contracting Officer or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the violation shall be at the Contractor's expense.

3.3 CLEAN-UP AND DISPOSAL

3.3.1 Housekeeping

Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the

general area. Use HEPA filtered vacuum cleaners. DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the Contracting Officer will attest that the area is safe before the signs can be removed. After final clean-up and acceptable airborne concentrations are attained but before the HEPA unit is turned off and the enclosure removed, remove all pre-filters on the building HVAC system and provide new pre-filters. Dispose of filters as asbestos contaminated materials. Reestablish HVAC mechanical, and electrical systems in proper working order. The Contracting Officer will visually inspect all surfaces within the enclosure for residual material or accumulated dust or debris. The Contractor shall re-clean all areas showing dust or residual materials. If re-cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re-cleaning. The Contracting Officer must agree that the area is safe in writing before unrestricted entry will be permitted. The Government shall have the option to perform monitoring to determine if the areas are safe before entry is permitted.

3.3.2 Title to Materials

All waste materials, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified in applicable local, State, and Federal regulations and herein.

3.3.3 Disposal of Asbestos

3.3.3.1 Procedure for Disposal

Collect asbestos waste, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 6 mils thick bags with the approved warnings and DOT labeling preprinted on the bag. The name of the waste generator and the location at which the waste was generated shall be clearly indicated on the outside of each container. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off Government property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be assigned by the Contracting Officer or his authorized representative. Procedure for hauling and disposal shall comply with 40 CFR 61-SUBPART M, State, regional, and local standards. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums shall wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

3.3.3.2 Asbestos Disposal Quantity Report

Direct the PQP to record and report, to the Contracting Officer, the amount of asbestos containing material removed and released for disposal. Deliver the report for the previous day at the beginning of each day shift with amounts of material removed during the previous day reported in linear feet or square feet as described initially in this specification and in cubic feet for the amount of asbestos containing material released for disposal.

Allow the COIH, if requested, to inspect, record and report the amount of asbestos containing material removed and released for disposal on a daily basis.

- - - END - - -

SECTION 02 83 13
LEAD IN CONSTRUCTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z88.2 (1992) Respirator Protection

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780 (1995; Errata Aug 1996; Rev Ch. 7 – 1997) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.103 Respiratory Protection

29 CFR 1926.21 Safety Training and Education

29 CFR 1926.33 Access to Employee Exposure and Medical Records

29 CFR 1926.55 Gases, Vapors, Fumes, Dusts, and Mists

29 CFR 1926.59 Hazard Communication

29 CFR 1926.62 Lead

29 CFR 1926.65 Hazardous Waste Occupations and Emergency Response

40 CFR 260 Hazardous Waste Management System: General

40 CFR 261 Identification and Listing of Hazardous Waste

40 CFR 262 Standards Applicable to Generators of Hazardous Waste

40 CFR 263 Standards Applicable to Transporters of Hazardous Waste

40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 2681 Land Disposal Restrictions

40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures

49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.

49 CFR 178 Specifications for Packaging

UNDERWRITERS LABORATORIES (UL)

UL 586 (1996; Rev thru Aug 2004) Standard for High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period.

1.2.2 Area Sampling

Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

1.2.3 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead hazard. A Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals is the best choice.

1.2.4 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

1.2.5 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

1.2.6 High Efficiency Particulate Air (HEPA) Air Filtering Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

1.2.7 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

1.2.8 Lead Control Area

A system of control methods to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

1.2.9 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula:

PEL (micrograms/cubic meter of air) = 400/No. hrs worked per day

1.2.10 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01%). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

1.2.11 Personal Sampling

Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees' work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of and centered at the nose or mouth of an employee.

1.2.12 Physical Boundary

Area physically roped or partitioned off around lead control area to limit unauthorized entry of personnel.

1.3 DESCRIPTION

1.3.1 Description of Work

Construction activities impacting lead-containing wall panels or material containing lead which are covered by this specification include the demolition and removal of material containing lead located within the project scope area.

1.3.2 Coordination with Other Work

The Contractor shall coordinate with work being performed in adjacent areas. Coordination procedures shall be explained in the Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or Government personnel performing work unrelated to lead activities.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Occupational and Environmental Assessment Data Report (if objective data is used to justify excluding the initial occupational exposure assessment); G

Lead Compliance Plan including CP approval (signature, date, and certification number); G

Competent Person qualification; G

Training Certification of workers and supervisors; G

lead waste management plan; G

written evidence that TSD is approved for lead disposal; G

Certification of Medical Examinations; G

SD-06 Test Reports

sampling results; G

Occupational and Environmental Assessment Data Report; G

SD-07 Certificates

Testing laboratory qualifications; G

Occupant Notification; G

Clearance Certification; G

SD-11 Closeout Submittals

Completed and signed hazardous waste manifest from treatment or disposal facility: G

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities. Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62) which shows ability to assess occupational and environmental exposure to lead, experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Submit proper documentation that the CP is trained, licensed and certified in accordance with federal, State (18 VAC 15-30) and local laws. The competent person shall be a licensed lead-based paint abatement Supervisor in the State of CT.

1.5.1.2 Training Certification

Submit a certificate for each worker and supervisor, signed and dated by the accredited training provider, stating that the employee has received the required lead training specified in 29 CFR 1926.62(l)and is certified to perform or supervise de-leading, lead removal or demolition activities in the state of CT.

1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform the air and wipe sample analysis, testing, and reporting of airborne concentrations of lead. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis shall be OSHA approved.

1.5.2 Requirements

1.5.2.1 Competent Person (CP) Responsibilities

a. Verify that training meets all federal, State, and local requirements.

b. Review and approve Lead Compliance Plan for conformance to the applicable referenced standards.
c. Continuously inspect MCL work for conformance with the approved plan.
d. Provide oversight of air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.
e. Ensure work is performed in strict accordance with specifications at all times.
f. Control work to prevent lead exposure to workers and to the environment at all times.
g. Supervise final cleaning of the lead control area, collect clearance wipe samples, if necessary; review clearance sample results and make recommendations for further cleaning, if necessary.
h. Certify the conditions of the work as called for elsewhere in this specification.

1.5.2.2 Lead Compliance Plan

Submit a detailed job-specific removal plan of the work procedures to be used in the disturbance of lead-containing material. The plan shall include a sketch showing the location, size, and details of lead control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity where lead-containing materials are impacted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead-related work, collected waste water and dust containing lead and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside of the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors and sub-contractors to inform affected employees and to clarify responsibilities to control exposures. The plan shall be developed by an EPA certified lead consultant.

The plan shall also include an occupant protection program that describes the measures that will be taken during the work to notify and protect the building occupants.

1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation of a negative exposure assessment. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Compliance Plan.

a. The initial monitoring shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.
b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition and power tool cleaning where lead-containing material is present.
c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead compliance plan per 29 CFR 1926.62.

1.5.2.4 Medical Examinations

Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

1.5.2.5 Training

Train each employee performing work that disturbs lead, who performs lead-containing material disposal and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations, where appropriate.

1.5.2.6 Respirator Protection Program

a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.
b. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.

1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

1.5.2.8 Lead Waste Management

The Lead Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations, and address:

a. Identification and classification of wastes associated with the work.
b. Estimated quantities of wastes to be generated and disposed of.
c. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of USEPA State (in accordance with 16 VAC 25-35) and local hazardous waste permits and USEPA Identification numbers.
d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Wastes shall be cleaned up and containerized daily.

h. Unit cost for hazardous waste disposal according to this plan.

1.5.2.9 Environmental Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead.

Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply. The following local and State laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing of lead-contaminated materials apply:

Licensing and certification in the state of CT is required.

1.5.3 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead Waste Management Plan and the Lead Compliance Plan, including procedures and precautions for the work.

1.6 EQUIPMENT

1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust, fume and mist. Respirators shall comply with the requirements of 29 CFR 1926.62.

1.6.2 Special Protective Clothing

Furnish personnel who will be exposed to lead-contaminated dust with proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

1.6.3 Rental Equipment Notification

If rental equipment is to be used during lead-containing material handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

1.6.5 Equipment for Governmental Personnel

Furnish the Contracting Officer with one complete set of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead removal work within the lead control area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE shall remain the property of the Contractor. The Government will provide respiratory protection for the Contracting Officer.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2-PRODUCTS

Not used.

PART 3-EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Notification

a. Notify the Contracting Officer 20 days prior to the start of any lead work.

3.1.1.2 Lead Control Area

a. Physical Boundary - Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside of the lead control area.
b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the them and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3.1.1.3 Furnishings

The Government will remove furniture and equipment from the project scope area before lead work begins.

3.1.1.4 Heating, Ventilating and Air Conditioning (HVAC) Systems

Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6 mil plastic sheeting and tape. Seal seams in HVAC components that pass through the lead control area. Provide temporary HVAC system for areas in which HVAC has been shut down outside the lead control area.

3.1.1.5 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.

3.1.1.6 Eye Wash Station

Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.

3.1.1.7 Mechanical Ventilation System

a. To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Local exhaust ventilation systems shall be evaluated and maintained in accordance with 29 CFR 1926.62.
b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.
c. Use locally exhausted, power actuated tools or manual hand tools.

3.1.1.8 Personnel Protection

Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

3.2 ERECTION

3.2.1 Lead Control Area Requirements

Full containment - Contain removal operations by the use of critical barriers and HEPA filtered exhaust negative pressure enclosure system with decontamination facilities and with HEPA filtered exhaust if required by the CP. For containment areas larger than 1,000 square feet install a minimum of two 18-inch square viewing ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.

3.3 APPLICATION

3.3.1 Lead Work

Perform lead work in accordance with approved Lead Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when the work is performed in accordance with 29 CFR 1926.62 or 40 CFR 745, and as specified herein. Dispose of all lead-containing material and associated waste in compliance with federal, State, and local requirements.

3.3.2 Material Containment During Lead Removal

Manual or power sanding or grinding of lead surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods.

The dry cutting or breaking of materials that contain lead is prohibited. Provide methodology for removing lead in the Lead Compliance Plan. Select lead removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this removal process in the Lead Compliance Plan.

3.3.2.1 Paint with Lead or Material Containing Lead-Indoor Removal

Perform removal in the lead control areas using enclosures, barriers or containments and powered locally exhausted tools. Collect residue debris for disposal in accordance with federal, State, and local requirements.

3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead-control area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn in the control area:

a. Vacuum all clothing before entering the contaminated change room.
b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
c. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing, move to an appropriate shower facility, shower.
d. Change to clean clothes prior to leaving the clean clothes storage area.

3.4 FIELD QUALITY CONTROL

3.4.1 Tests

3.4.1.1 Air and Wipe Sampling

Conduct sampling for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.

a. The CP shall be on the job site directing the air and wipe sampling and inspecting the lead-containing material removal work to ensure that the requirements of the contract have been satisfied during the removal operation.

b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.

c. Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken.

d. Conduct area air sampling daily, on each shift in which lead-containing material removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the conditions(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after the CP and the Contracting Officer give approval.

e. Surface Wipe Samples: Collect surface wipe samples on floors at a location no greater than 10 feet outside the lead control area at a frequency of once per day while lead removal work is being conducted. Surface wipe results shall meet criteria in paragraph ‘Clearance Certification.’

3.4.1.2 Sampling After Removal

After the visual inspection, collect wipe samples according to the HUD protocol contained in HUD 6780 to determine the lead content of settled dust in micrograms per square foot of surface area.

3.4.1.3 Testing of Material Containing Lead Residue

Test residue in accordance with 40 CFR 261 for hazardous waste.

3.5 CLEANING AND DISPOSAL

3.5.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead operation has been completed, clean the controlled area of visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead Control Plan. Re-clean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before clearance testing.

3.5.1.1 Clearance Certification

The CP shall certify in writing that air samples collected outside the lead control area during removal operations are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62; and that there were no visible accumulations of material and dust containing lead left in the lead control area. Do not remove the lead control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification. Certify that the results of surface wipe samples are not significantly greater than the initial surface loading determined prior to work.

3.5.2 Disposal

a. All material, whether hazardous or non-hazardous shall be disposed in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.
b. Contractor is responsible for segregation of waste. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261.
c. Dispose of lead-contaminated material classified as hazardous waste at an EPA approved hazardous waste treatment, storage, or disposal facility off Government property.
d. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. For hazardous waste, the collection drum requires marking/labeling in accordance with 40 CFR 262 during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
e. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

3.5.2.1 Disposal Documentation

Submit written evidence to demonstrate that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Contractor shall provide a certificate that the waste was accepted by the disposal facility.

3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials or non-hazardous waste delivered is returned and a copy is furnished to the Government.

- - - END - - -

SECTION 02 84 16
HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

DISTRICT OF COLUMBIA MUNICIPAL REGULATIONS (DCMR)

20 DCMR(1997) Environment - Chapters 40 to 70, Subtitle E: Hazardous Waste, Chapters 40 - 70

STATE OF MARYLAND CODE OF MARYLAND REGULATIONS (COMAR)

COMAR 26.13(1988) Chapters .01- .13, Disposal of Controlled Hazardous Substances

STATE OF VIRGINIA ADMINISTRATIVE CODE (VAC)

9 VAC 20-60Title 9, Agency 20, Chapter 60: Hazardous Waste Management Regulations

9 VAC 20-80Title 9, Agency 20, Chapter 80: Solid Waste Management Regulations

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000Air Contaminants

40 CFR 260Hazardous Waste Management System: General

40 CFR 261Identification and Listing of Hazardous Waste

40 CFR 262Standards Applicable to Generators of Hazardous Waste

40 CFR 263Standards Applicable to Transporters of Hazardous Waste

40 CFR 264Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 268Land Disposal Restrictions

40 CFR 270EPA Administered Permit Programs: The Hazardous Waste Permit Program

40 CFR 273Standards For Universal Waste Management

40 CFR 761Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

49 CFR 178Specifications for Packagings

1.2 REQUIREMENTS

Removal and disposal of PCB containing lighting ballasts and associated mercury-containing lamps. Contractor may encounter leaking PCB ballasts.

1.3 DEFINITIONS

1.3.1 Certified Industrial Hygienist (CIH)

A industrial hygienist hired by the Contractor shall be certified by the American Board of Industrial Hygiene.

1.3.2 Leak

Leak or leaking means any instance in which a PCB article, PCB container, or PCB equipment has any PCBs on any portion of its external surface.

1.3.3 Lamps

Lamp, also referred to as "universal waste lamp", is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infra-red regions of the electromagnetic spectrum. Examples of common universal waste electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

1.3.4 Polychlorinated Biphenyls (PCBs)

PCBs as used in this specification shall mean the same as PCBs, PCB containing lighting ballast, and PCB container, as defined in 40 CFR 761, Section 3, Definitions.

1.3.5 Spill

Spill means both intentional and unintentional spills, leaks, and other uncontrolled discharges when the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases.

1.3.6 Universal Waste

Universal Waste means any of the following hazardous wastes that are managed under the universal waste requirements 40 CFR 273:

(1) Batteries as described in Sec. 273.2 of this chapter;

(2) Pesticides as described in Sec. 273.3 of this chapter;
(3) Thermostats as described in Sec. 273.4 of this chapter; and
(4) Lamps as described in Sec. 273.5 of this chapter.

1.4 QUALITY ASSURANCE

1.4.1 Regulatory Requirements

Perform PCB related work in accordance with 40 CFR 761 and [COMAR 26.13] [9 VAC 20-60 and 9 VAC 20-80] [20 DCMR]. [Perform mercury-containing lamps storage and transport in accordance with 40 CFR 261, 40 CFR 264, 40 CFR 265, 40 CFR 273 and [COMAR 26.13] [9 VAC 20-60 and 9 VAC 20-80] [20 DCMR].]

1.4.2 Training

Certified industrial hygienist (CIH) shall instruct and certify the training of all persons involved in the removal of PCB containing lighting ballasts and mercury-containing lamps. The instruction shall include: The dangers of PCB and mercury exposure, decontamination, safe work practices, and applicable OSHA and EPA regulations. The CIH shall review and approve the PCB and Mercury-Containing Lamp Removal Work Plans.

1.4.3 Regulation Documents

Maintain at all times one copy each at the office and one copy each in view at the job site of 29 CFR 1910.1000, 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 265, 40 CFR 268, 40 CFR 270, 40 CFR 273 and [COMAR 26.13] [9 VAC 20-60 9 VAC 20-80] [20 DCMR] and of the Contractor removal work plan and disposal plan for PCB and for associated mercury-containing lamps.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Qualifications of CIH; G

Training Certification; G

PCB and Lamp Removal Work Plan; G

PCB and Lamp Disposal Plan; G

SD-11 Closeout Submittals

Transporter certification of notification to EPA of their PCB waste activities and EPA ID numbers; G

Certification of Decontamination

Certificate of Disposal and/or recycling. Submit to the Government before application for payment within 30 days of the date that the disposal of the PCB and mercury-containing lamp waste identified on the manifest was completed.

DD Form 1348-1

1.6 ENVIRONMENTAL REQUIREMENTS

Use special clothing:

a. Disposable gloves (polyethylene)

b. Eye protection

c. PPE as required by CIH

1.7 SCHEDULING

Notify the Contracting Officer 20 days prior to the start of PCB and mercury-containing lamp removal work.

1.8 QUALITY ASSURANCE

1.8.1 Qualifications of CIH

Submit the name, address, and telephone number of the Industrial Hygienist selected to perform the duties in paragraph entitled "Certified Industrial Hygienist." Submit training certification that the Industrial Hygienist is certified, including certification number and date of certification or re certification.

1.8.2 PCB and Lamp Removal Work Plan

Submit a job-specific plan within 20 calendar days after award of contract of the work procedures to be used in the removal, packaging, and storage of PCB-containing lighting ballasts and associated mercury-containing lamps. Include in the plan: Requirements for Personal Protective Equipment (PPE), spill cleanup procedures and equipment, eating, smoking and restroom procedures. The plan shall be approved and signed by the Certified Industrial Hygienist. Obtain approval of the plan by the Contracting Officer prior to the start of PCB and/or lamp removal work.

1.8.3 PCB and Lamp Disposal Plan

Submit a PCB and lamp Disposal Plan with 45 calendar days after award of contract. The PCB and Lamp Disposal Plan shall comply with

applicable requirements of federal, state, and local PCB and Universal waste regulations and address:

a. Estimated quantities of wastes to be generated, disposed of, and recycled.

b. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location. Furnish two copies of EPA and state PCB and mercury-containing lamp waste permit applications and EPA identification numbers, as required.

c. Names and qualifications (experience and training) of personnel who will be working on-site with PCB and mercury-containing lamp wastes.

d. Spill prevention, containment, and cleanup contingency measures to be implemented.

e. Work plan and schedule for PCB and mercury-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerize

d. Daily.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 WORK PROCEDURE

Furnish labor, materials, services, and equipment necessary for the removal of PCB containing lighting ballasts, associated mercury-containing fluorescent lamps, in accordance with local, state, or federal regulations. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition by-products may be produced. Do not break mercury containing fluorescent lamps or high intensity discharge lamps.

3.1.1 Work Operations

Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with 40 CFR 761, 40 CFR 262 40 CFR 263, and the applicable requirements of this section, including but not limited to:

a. Obtaining suitable PCB and mercury-containing lamp storage sites.

b. Notifying Contracting Officer prior to commencing the operation.

c. Reporting leaks and spills to the Contracting Officer.

d. Cleaning up spills.

e. Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.

f. Maintaining inspection, inventory and spill records.

3.2 PCB SPILL CLEANUP REQUIREMENTS

3.2.1 PCB Spills

Immediately report to the Contracting Officer any PCB spills.

3.2.2 PCB Spill Control Area

Rope off an area around the edges of a PCB leak or spill and post a "PCB Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to a drip pan or other container.

3.2.3 PCB Spill Cleanup

40 CFR 761, subpart G. Initiate cleanup of spills as soon as possible, but no later than 24 hours of its discovery. Mop up the liquid with rags or other conventional absorbent. The spent absorbent shall be properly contained and disposed of as solid PCB waste.

3.2.4 Records and Certification

Document the cleanup with records of decontamination in accordance with 40 CFR 761, Section 125, Requirements for PCB Spill Cleanup. Provide test results of cleanup and certification of decontamination.

3.3 REMOVAL

3.3.1 Ballasts

As ballast are removed from the lighting fixture, inspect label on ballast. Ballasts without a "No PCB" label shall be assumed to contain PCBs and containerized and disposed of as required under paragraphs STORAGE FOR DISPOSAL and DISPOSAL. If there are less than 1600 "No PCB" labeled lighting ballasts dispose of them as normal demolition debris.

3.3.2 Lighting Lamps

Remove lighting tubes/lamps from the lighting fixture and carefully place (unbroken) into appropriate containers (original transport boxes or equivalent). In the event of a lighting tube/lamp breaking, sweep and place waste in double plastic taped bags and dispose of as universal waste as specified herein.

3.4 STORAGE FOR DISPOSAL

3.4.1 Storage Containers for PCBs

49 CFR 178. Store PCB in containers approved by DOT for PCB.

3.4.2 Storage Containers for lamps

Store mercury containing lamps in appropriate DOT containers. The boxes shall be stored and labeled for transport in accordance with 40 CFR 273.

3.4.3 Labeling of Waste Containers

Label with the following:

a. Date the item was placed in storage and the name of the cognizant activity/building.

b. "Caution Contains PCB," conforming to 40 CFR 761, CFR Subpart C. Affix labels to PCB waste containers.

c. Label mercury-containing lamp waste in accordance with 40 CFR 273. Affix labels to all lighting waste containers.

3.5 DISPOSAL

Dispose of off Government property in accordance with EPA, DOT, and local regulations at a permitted site.

3.5.1 Identification Number

Federal regulations 40 CFR 761, and 40 CFR 263 require that generators, transporters, commercial storers, and disposers of PCB waste posses U.S. EPA identification numbers. The Contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Uniform Hazardous Waste manifest. If not, the Contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work. For mercury containing lamp removal, Federal regulations 40 CFR 273 require that large quantity handlers of Universal waste (LQHUW) must provide notification of universal waste management to the appropriate EPA Region (or state director in authorized states), obtain an EPA identification number, and retain for three years records of off-site shipments of universal waste. The contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Universal Waste manifest. If not, the Contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work.

3.5.2 Transporter Certification

Comply with disposal and transportation requirements outlined in 40 CFR 761 and 40 CFR 263. Before transporting the PCB waste, sign and date the manifest acknowledging acceptance of the PCB waste from the Government. Return a signed copy to the Government before leaving the job site. Ensure that the manifest accompanies the PCB waste at all times. Submit transporter certification of notification to EPA of their PCB waste activities (EPA Form 7710-53).

3.5.2.1 Certificate of Disposal and/or Recycling

40 CFR 761. Certificate for the PCBs and PCB items disposed shall include:

a. The identity of the disposal and or recycling facility, by name, address, and EPA identification number.

b. The identity of the PCB waste affected by the Certificate of Disposal including reference to the manifest number for the shipment.

c. A statement certifying the fact of disposal and or recycling of the identified PCB waste, including the date(s) of disposal, and identifying the disposal process used.

d. A certification as defined in 40 CFR 761.

- - - END - - -

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.2 RELATED WORK:

A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.

B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

C. Cement board sheathing: Section 06 16 63, CEMENTITIOUS SHEATHING.

1.3 SUMBITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.

B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

C. Stack plywood and other board products so as to prevent warping.

D. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Forest and Paper Association (AFPA):
National Design Specification for Wood Construction
NDS-05.....Conventional Wood Frame Construction

C. American Institute of Timber Construction (AITC):
A190.1-02.....Structural Glued Laminated Timber

D. American Society of Mechanical Engineers (ASME):
B18.2.1A-96(R2005).....Square and Hex Bolts and Screws
B18.2.2-87(R2005).....Square and Hex Nuts
B18.6.1-81 (R97).....Wood Screws

B18.6.4-98(R2005).....Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws

E. American Plywood Association (APA):

E30-03.....Engineered Wood Construction Guide

F. American Society for Testing And Materials (ASTM):

A47-99(R2004).....Ferritic Malleable Iron Castings

A48-03.....Gray Iron Castings

A653/A653M-07.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

C954-04.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness

C1002-04.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs

D143-94(R2004).....Small Clear Specimens of Timber, Method of Testing

D1760-01.....Pressure Treatment of Timber Products

D2559-04.....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions

D3498-03.....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

F844-07.....Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-05.....Nails, Spikes, and Staples

G. Federal Specifications (Fed. Spec.):

MM-L-736C.....Lumber; Hardwood

H. Commercial Item Description (CID):

A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)

I. Military Specification (Mil. Spec.):

MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

J. Truss Plate Institute (TPI):

TPI-85.....Metal Plate Connected Wood Trusses

K. U.S. Department of Commerce Product Standard (PS)

PS 1-95.....Construction and Industrial Plywood

PS 20-05.....American Softwood Lumber Standard

PART 2 - PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
   1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
   2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA, National Design Specification for Wood Construction having design stresses as shown.

C. Lumber Other Than Structural:
   1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
   2. Framing lumber: Minimum extreme fiber stress in bending of 1100.
   3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.

D. Sizes:
   1. Conforming to Prod. Std., PS20.
   2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:
   1. At time of delivery and maintained at the site.
   2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
   3. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:
   1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
   2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:
   1. Do not treat Heart Redwood and Western Red Cedar.

2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

2.2 PLYWOOD

A. Comply with Prod. Std., PS 1.
B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

2.3 ROUGH HARDWARE AND ADHESIVES:

A. Anchor Bolts:
   1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
   2. Extend at least 200 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).
B. Miscellaneous Bolts: Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.
C. Washers
   1. ASTM F844.
   2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.
D. Screws:
   1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
   2. Wood to Steel: ASTM C954, or ASTM C1002.
E. Nails:
   1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
   2. ASTM F1667:
      a. Common: Type I, Style 10.
      b. Concrete: Type I, Style 11.
      c. Barbed: Type I, Style 26.

d. Underlayment: Type I, Style 25.

e. Masonry: Type I, Style 27.

f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Adhesives:

1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
2. For structural laminated Wood: ASTM D2559.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:

1. AFPA National Design Specification for Wood Construction for timber connectors.
2. AITC Timber Construction Manual for heavy timber construction.
3. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.
4. APA for installation of plywood or structural use panels.
5. ASTM F 499 for wood underlayment.
6. TPI for metal plate connected wood trusses.

B. Fasteners:

1. Nails.

a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.

b. Use special nails with framing connectors.

c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.

d. Use eight penny or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.

e. Use 16 penny or larger nails for nailing through 50 mm (2 inch) thick lumber.

f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.

g. Nailing Schedule; Using Common Nails:

1) Joist bearing on sill or girder, toe nail three-8d or framing anchor

2) Bridging to joist, toe nail each end two-8d
3) Ledger strip to beam or girder three-16d under each joint.
4) Subflooring or Sheathing:
   a) 150 mm (6 inch) wide or less to each joist face nail two-8d.
   b) Subflooring, more than 150 mm (6 inches) wide, to each stud or joint, face nail three-8d.
   c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 150 mm (6 inches) on center and at intermediate supports 250 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 300 mm (12 inches) at supported edges and 500 mm (20 inches) o.c. at intermediate supports.
5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 400 mm (16 inches) on center.
6) Top plate to stud, end nail two-16d.
7) Stud to sole plate, toe nail or framing anchor. Four-8d
8) Doubled studs, face nail 16d at 600 mm (24 inches) on center.
9) Built-up corner studs 16d at 600 mm (24 inches) (24 inches) on center.
10) Doubled top plates, face nails 16d at 400 mm (16 inches) on center.
11) Top plates, laps, and intersections, face nail two-16d.
12) Continuous header, two pieces 16d at 400 mm (16 inches) on center along each edge.
13) Ceiling joists to plate, toenail three-8d or framing anchor.
14) Continuous header to stud, four 16d.
15) Ceiling joists, laps over partitions, face nail three-16d or framing anchor.
16) Ceiling joists, to parallel rafters, face nail three-16d.
17) Rafter to plate, toe nail three-8d. or framing anchor. Brace 25 mm (1 inch) thick board to each stud and plate, face nail three-8d.
18) Built-up girders and beams 20d at 800 mm (32 inches) on center along each edge.

2. Bolts:
   a. Fit bolt heads and nuts bearing on wood with washers.
   b. Countersink bolt heads flush with the surface of nailers.
   c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.

d. Use toggle bolts to hollow masonry or sheet metal.

e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.

3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.

a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.

b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.

4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.

5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.

6. Screws to Join Wood:

a. Where shown or option to nails.

b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.

c. Spaced same as nails.

C. Blocking Nailers, and Furring:

1. Install furring, blocking, nailers, and grounds where shown.

2. Use longest lengths practicable.

3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.

4. Layers of Blocking or Plates:

a. Stagger end joints between upper and lower pieces.

b. Nail at ends and not over 600 mm (24 inches) between ends.

c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.

- - - E N D - - -

SECTION 06 16 63
CEMENTITIOUS SHEATHING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies cement board sheathing applied to frame wall construction, ready to receive subsequent finishes.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: 1. Cement board panels, 200 mm by 200 mm (8 inches by 8 inches), minimum size.

2. Fasteners, each type used.

3. Reinforcing tape for joints 300 mm (12 inches) long.

4. Water barrier backing, 300 mm (12 inches) square.

C. Product Data:

1. Cement board sheathing.

2. Reinforcing tape.

3. Fasteners.

1.3 DELIVERY AND STORAGE

A. Deliver materials in containers with labels legible and intact.

B. Store materials so as to prevent damage or contamination.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI):

A108.11-1999.....Interior Installation of Cementitious Backer Units

A118.9-1999.....Cementitious Backer Units

C. American Society for Testing and Materials (ASTM):

C954-04.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

D226-06.....Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

D4586-07.....Asphalt Roof Cement, Asbestos-Free

D. Federal Specifications (FS):

UU-B-790.....Building Paper, Vegetable Fiber INT AMD 1 (Kraft, Waterproofed, Water Repellant and Fire Resistant)

PART 2 - PRODUCTS

2.1 CEMENT BOARD SHEATHING

A. Conform to ANSI A118.9, except physical property requirements defined in Table 1 changed to not less than the minimum values stated below.

B. Property Minimum Average Value

1. Water Absorption by Weight, ASTM D1037	20 percent maximum
2. Flame Spread	5
3. Smoke Density	0
4. Thickness	13 mm (1/2 inch)
5. Minimum Width	800 mm (32 inches)
6. Flexural Strength wet and dry	6895 kpa (1000 psi)
7. Fastener Holding wet and dry	33 kpa (125 pounds)

2.2 ACCESSORY MATERIALS

A. Steel Drill Screws: ASTM C954. Modified for flat head. Bugle head not acceptable.

B. Organic Felt: ASTM D226, Type II, 13.6 kg (30 lb).

C. Roof Cement: ASTM D4586

D. Joint Reinforcing Tape:

1. Minimum 100 mm (4-inches) wide open mesh alkali resistant.
2. Glass fiber mesh polymer coated as recommended by Cement Board manufacturer.

E. Water Barrier: FS UU-B-790. Type I (Barrier paper), Grade D (Water-vapor permeable). Other products meeting or exceeding the Federal specification for a water barrier with water vapor permeability are acceptable.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Do not install units when temperature is below 4.5 degrees Celsius (40 degrees F).

B. Do not install joint reinforcing tape when temperature is below 10 degrees Celsius (50 degrees F).

3.2 INSTALLATION

A. Remove wrapping and separate to allow air circulation for not less than seven days before installation.

B. Installing Water Barrier over Framing Members:

1. Apply roof cement or tape to framing members sufficient to adhere and support water barrier.
2. Use either organic felt or water barrier.

3. Apply barrier shingle fashion with horizontal joints lapped not less than 50 mm (2 inches). Lap end joints over framing, not less than 100 mm (4 inches) cemented together with roof cement, stagger end joints.
4. Do not leave over 300 mm (12-inch) wide strip exposed when work is stopped.
5. Coordinate with installation of flashing to lap water barrier over flashing. Install weeps every 600 mm (24 inches) or as detailed, directly above flashing. Provide for clear exit of water to exterior.
6. Repair torn or cut barrier with barrier patch spanning framing space cemented to surface along top and side edges.

C. Installing Cement Board Units:
1. Apply cement board sheathing immediately over water barrier in accordance with ANSI A108.11, with rounded edges and rough side to exterior, except as specified otherwise.
2. Secure units to framing members with screws spaced not more than 200 mm (8 inches) on center and not closer than 13 mm (1/2-inch) from the edge of the unit.
3. Install screws so that the screw heads do not penetrate the surface of unit.
4. Install 13 mm (1/2-inch) wide horizontal control joints at floors and vertical control joints not over 4.87 m (16 feet) on center unless shown otherwise, maintain alignment.
5. Stop units at edges of building expansion joints.
6. Minimum bearing over framing members: 19 mm (3/4-inch.)

D. Joint and Surface Treatment: Apply joint reinforcing tape over joints, exposed edges, and corners using adhesive recommended by manufacturer.

E. Leave surface flush and ready to receive subsequent finishes.

3.3 PROTECTION AND REPAIR

A. Protect board with temporary coverings against moisture until subsequent finish is applied.

B. Patch and repair damaged surface prior to application of subsequent finish.
1. Fill cracks.
2. Replace loose, spalling or missing joint finish.
3. Replace broken or damaged boards.

- - - E N D - - -

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies exterior and interior millwork.

B. Items specified.

- Counter or Work Tops

1.2 RELATED WORK

A. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.

B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.

C. Wood doors: Section 08 14 00, WOOD DOORS.

D. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

E. Stock Casework: Section 12 32 00, MANUFACTURED WOOD CASEWORK.

F. Other Countertops: Division 11, EQUIPMENT and Division 12, FURNISHINGS.

G. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Millwork items - Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
2. Show construction and installation.

C. Samples:

Plastic laminate finished plywood or particleboard, 150 mm by 300 mm (six by twelve inches).

D. Certificates:

1. Indicating fire retardant treatment of materials meet the requirements specified.
2. Indicating moisture content of materials meet the requirements specified.

E. List of acceptable sealers for fire retardant and preservative treated materials.

F. Manufacturer's literature and data:

1. Finish hardware
2. Sinks with fittings
3. Electrical components

1.3 DELIVERY, STORAGE AND HANDLING

A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.

B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by Resident Engineer. Store at a minimum temperature of 21^{0}C (70^{0}F) for not less than 10 days before installation.

C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Testing and Materials (ASTM):

A36/A36M-05.....Structural Steel

A53-06.....Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless

A167-99 (R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B26/B26M-05.....Aluminum-Alloy Sand Castings

B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

E84-07.....Surface Burning Characteristics of Building Materials

F436-07.....Hardened Steel Washers

C. American Hardboard Association (AHA):

A135.4-04.....Basic Hardboard

D. Builders Hardware Manufacturers Association (BHMA):

A156.9-03.....Cabinet Hardware

A156.11-04.....Cabinet Locks

A156.16-02.....Auxiliary Hardware

E. Hardwood Plywood and Veneer Association (HPVA):

HP1-04.....Hardwood and Decorative Plywood

F. National Particleboard Association (NPA):

A208.1-99.....Wood Particleboard

G. American Society of Mechanical Engineers (ASME):

B18.2.1-96(R2005).....Square and Hex Bolts and Screws (Inch Series)

H. American Wood-Preservers' Association (AWPA):

AWPA C1-03.....All Timber Products - Preservative Treatment by Pressure Processes

I. Architectural Woodwork Institute (AWI):

AWI-99.....Architectural Woodwork Quality Standards and Quality Certification Program

J. National Electrical Manufacturers Association (NEMA):

LD 3-05.....High-Pressure Decorative Laminates

LD 3.1-95.....Application, Fabrication and Installation of High-Pressure Decorative Laminates

K. U.S. Department of Commerce, Product Standard (PS):

PS1-95.....Construction and Industrial Plywood

PS20-05.....American Softwood Lumber Standard

L. Military Specification (Mil. Spec):

MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

M. Federal Specifications (Fed. Spec.):

A-A-1922A.....Shield Expansion

A-A-1936.....Contact Adhesive

FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castle

FF-S-111D(1).....Screw, Wood

MM-L-736(C).....Lumber, Hardwood

PART 2 - PRODUCTS

2.1 LUMBER

A. Grading and Marking:

1. Lumber shall bear the grade mark, stamp, or other identifying marks indicating grades of material.
2. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
3. The inspection agency for lumber shall be approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Sizes:

1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
2. Millwork, standing and running trim, and rails: Actual size as shown or specified.

C. Hardwood: MM-L-736, species as specified for each item.

D. Softwood: PS-20, exposed to view appearance grades:

1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.

2. Use Prime for painted or opaque finish.

E. Use edge grain Wood members exposed to weather.

2.2 PLYWOOD

A. Softwood Plywood:

1. Prod. Std.
2. Grading and Marking:
   a. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.
   b. The mark shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with PS1.
3. Plywood, 13 mm (1/2 inch) and thicker; not less than five ply construction, except 32 mm (1-1/4 inch) thick plywood not less than seven ply.
4. Plastic Laminate Plywood Cores:
   a. Exterior Type, and species group.
   b. Veneer Grade: A-C.
5. Shelving Plywood:
   a. Interior Type, any species group.
   b. Veneer Grade: A-B or B-C.
6. Other: As specified for item.

B. Hardwood Plywood:

1. HPVA: HP.1
2. Species of face veneer shall be as shown or as specified in connection with each particular item.
3. Inside of Building:
   a. Use Type II (interior) A grade veneer for transparent finish.
   b. Use Type II (interior) Sound Grade veneer for paint finish.
4. On Outside of Building:
   a. Use Type I, (exterior) A Grade veneer for natural or stained and varnish finish.
   b. Use Type I, (exterior) Sound Grade veneer for paint finish.
5. Use plain sliced red oak unless specified otherwise.

2.3 PARTICLEBOARD

A. NPA A208.1

B. Plastic Laminate Particleboard Cores:

1. Use Type 1, Grade 1-M-3, or Type 2, Grade 2-M-2, unless otherwise specified.
2. Use Type 2, Grade 2-M-2, exterior bond, for tops with sinks.

C. General Use: Type 1, Grade 1-M-3 or Type 2, Grade 2-M-2.

2.4 PLASTIC LAMINATE

A. NEMA LD-3.

B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General Purpose, Type HGL.

C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA, CLS as a minimum.

1. Plastic laminate clad plywood or particle board.
2. Resin impregnated decorative paper thermally fused to particle board.

D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.

E. Post Forming Fabrication, Decorative Surfaces: Post forming, Type HGP.

2.5 BUILDING BOARD (HARDBOARD)

A. ANSI/AHA A135.4, 6 mm (1/4 inch) thick unless specified otherwise.

B. Perforated hardboard (Pegboard): Type 1, Tempered perforated 6 mm (1/4 inch) diameter holes, on 25 mm (1 inch) centers each way, smooth surface one side.

C. Wall paneling at gas chain rack: Type 1, tempered, Fire Retardant treated, smooth surface on side.

2.6 ADHESIVE

A. For Plastic Laminate: Fed. Spec. A-A-1936.

B. For Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.

C. For Exterior Millwork: Unextended melamine resin, phenol resin, or resorcinol resin.

2.7 STAINLESS STEEL

ASTM A167, Type 302 or 304.

2.8 ALUMINUM CAST

ASTM B26

2.9 ALUMINUM EXTRUDED

ASTM B221

2.10 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process. Galvanized where specified.

2. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
3. Fasteners:
   a. Bolts with Nuts: FF-N-836.
   b. Expansion Bolts: A-A-1922A.
   c. Screws: Fed. Spec. FF-S-111.

B. Finish Hardware
1. Cabinet Hardware: ANSI A156.9.
   a. Door/Drawer Pulls: B02011. Door in seismic zones: B03182.
   b. Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm 3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.
   c. Sliding Door Tracks: B07063.
   d. Adjustable Shelf Standards: B4061 with shelf rest B04083.
   e. Concealed Hinges: B1601, minimum 110 degree opening.
   f. Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
   g. Cabinet Door Catch: B0371 or B03172.
   h. Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.
2. Cabinet Locks: ANSI A156.11.
   a. Drawers and Hinged Door: E07262.
   b. Sliding Door: E07162.
3. Auxiliary Hardware: ANSI A156.16.
   a. Shelf Bracket: B04041, japanned or enameled finish.
   b. Combination Garment rod and Shelf Support: B04051 japanned or enamel finish.
   c. Closet Bar: L03131 chrome finish of required length.
   d. Handrail Brackets: L03081 or L03101.
      1) Cast Aluminum, satin polished finish.
      2) Cast Malleable Iron, japanned or enamel finish.
4. Steel Channel Frame and Leg supports for Counter top. Fabricated under Section 05 50 00, METAL FABRICATIONS.
5. Pipe Bench Supports:
   a. Pipe: ASTM A53.
6. Fabricated Wall Bench Supports:
   a. Steel Angles: ASTM A36 steel with chrome finish, or ASTM A167, stainless steel with countersunk wood screws, holes at 64 mm (2-1/2 inches) on center on horizontal member.

b. Use 38 mm by 38 mm by 5 mm (1-1/2 by 1-1/2 by 3/16 inch) angle thick drilled for screw and bolt holes unless shown otherwise. Drill 6 mm (1/4 inch) holes for anchors on vertical member, not more than 200 mm (8 inches) on center between ends or corners.

c. Stainless steel bars brackets: ASTM A167, fabricated to shapes shown, Number 4 finish. Use 50 mm by 5 mm (2 inch by 3/16 inch) bars unless shown otherwise. Drill for anchors and screws. Drill countersunk wood screw holes at 64 mm (2-1/2 inches) on center on horizontal members and not less than two 13 mm (1/4 inch) hole for anchors on vertical member.

7. Thru-Wall Counter Brackets:
   a. Steel angles drilled for fasteners on 100 mm (4 inches) centers.
   b. Baked enamel prime coat finish.
8. Folding Shelf Bracket:
   a. Steel Shelf bracket, approximately 400 mm by 400 mm (16 by 16 inches), folding type with baked gray enamel finish or chrome plated finish.
   b. Bracket legs shall be approximately 28 mm (1-1/8 inches) wide.
   c. Distance from center line of hinge pin to back of vertical leg shall be 44 mm (1-3/4 inches) or provide for wood spacer if hinge line is at joint of vertical and horizontal leg.
   d. Distance from face to face of bracket when closed shall be 50 mm (2 inches).
   e. Brackets shall automatically lock when counter is raised parallel to floor and shall unlock manually.
   f. Each bracket shall support not less than 68 Kg (150 pounds) evenly distributed.
9. Edge Strips Moldings:
   a. Driven type "T" shape with serrated retaining stem; vinyl plastic to match plastic laminate color, stainless steel, or 3 mm (1/8 inch) thick extruded aluminum.
   b. Stainless steel or extruded aluminum channels.
   c. Stainless steel, number 4 finish; aluminum, mechanical applied medium satin finish, clear anodized 0.1 mm (0.4 mils) thick.
10. Rubber or Vinyl molding
    a. Rubber or vinyl standard stock and in longest lengths practicable.
    b. Design for closures at joints with walls and adhesive anchorage.
    c. Adhesive as recommended by molding manufacturer.
11. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

2.11 MOISTURE CONTENT

A. Moisture content of lumber and millwork at time of delivery to site.
   1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
   2. Exterior treated or untreated finish lumber and trim 100 mm (4 inches) or less in nominal thickness: 15 percent.
   3. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

2.12 FIRE RETARDANT TREATMENT

A. Where wood members and plywood are specified to be fire retardant treated, the treatment shall be in accordance with Mil. Spec. MIL-L19140.
B. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings.
C. Each piece of treated material shall bear identification of the testing agency and shall indicate performance in accordance with such rating of flame spread and smoke developed.
D. Treat wood for maximum flame spread of 25 and smoke developed of 25.
E. Fire Resistant Softwood Plywood:
   1. Use Grade A, Exterior, plywood for treatment.
   2. Meet the following requirements when tested in accordance with ASTM E84.
      a. Flame spread: 0 to 25.
      b. Smoke developed: 100 maximum
F. Fire Resistant Hardwood Plywood:
   1. Core: Fire retardant treated softwood plywood.
   2. Hardwood face and back veneers untreated,
   3. Factory seal panel edges, to prevent loss of fire retardant salts.

2.13 PRESERVATIVE TREATMENT

Wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including wood members used for rough framing of millwork items except heart-wood Redwood and Western Red Cedar shall be preservative treated in accordance with AWPA Standards.

B. Use Grade A, exterior plywood for treatment.

2.14 FABRICATION

A. General:
   1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.

2. Finish woodwork shall be free from pitch pockets.
3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
4. Plywood shall be not less than 13 mm (1/2 inch), unless otherwise shown or specified.
5. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.
6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded a shown.
7. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.
8. Plastic Laminate Work:
   a. Factory glued to either a plywood or a particle board core, thickness as shown or specified.
   b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
   c. Provide plastic backing sheet on underside of countertops, vanity tops, thru-wall counter and sills including back splashes and end splashes of countertops.
   d. Use backing sheet on concealed large panel surface when decorative face does not occur.

B. Mounting Strips, Shelves and Rods:
1. Cut mounting strips from 25 mm by 100 mm (1 by 4 inches) softwood stock, with exposed edge slightly rounded.
2. Cut wood shelf from softwood 1 inch stock, of width shown, exposed edge slightly rounded. Option: Use 19 mm (3/4 inch) thick plywood with 19 mm (3/4 inch) softwood edge nosing on exposed edge, slightly rounded.
3. Plastic laminate covered, 19 mm (3/4 inch) thick plywood or particle board core with edges and ends having plastic molded edge strips. Size, finish and number as shown.
4. Rod or Closet Bar: L03131. Combination Garment and Shelf Support, intermediate support for closet bar: B04051 for rods over 1800 mm (6 feet) long.

C. Counter or Work Tops:
1. Fabrication with plastic laminate over 32 mm (1-1/4 inch) thick core unless shown otherwise.

a. Use decorative laminate for exposed edges of tops 38 mm (1-1/2 inches) wide and on back splash and end splash. Use plastic or metal edges for top edges less than 38 mm (1-1/2 inches) wide.
b. Assemble back splash and end splash to counter top.
c. Use one piece counters for straight runs.
d. Miter corners for field joints with overlapping blocking on underside of joint.

2. Fabricate wood counter for work benches as shown.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain work areas and storage areas to a minimum temperature of 21^{0}C (70^{0}F) for not less than 10 days before and during installation of interior millwork.

B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

3.2 INSTALLATION

A. General:

1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
2. Secure trim with fine finishing nails, screws, or glue as required.
3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
4. Seal cut edges of preservative and fire retardant treated wood materials with a certified acceptable sealer.
5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
6. Plumb and level items unless shown otherwise.
7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
8. Exterior Work: Joints shall be close fitted, metered, tongue and grooved, rebated, or lapped to exclude water and made up in thick white lead paste in oil.

B. Shelves:

1. Install mounting strip at back wall and end wall for shelves in closets where shown secured with toggle bolts at each end and not over 600 mm (24 inch) centers between ends.

a. Nail Shelf to mounting strip at ends and to back wall strip at not over 900 mm (36 inches) on center.
b. Install metal bracket, ANSI A156.16, B04041, not over 1200 mm (4 feet) centers when shelves exceed 1800 mm (6 feet) in length.
c. Install metal bracket, ANSI A156.16, B04051, not over 1200 mm (4 feet) on centers where shelf length exceeds 1800 mm (6 feet) in length with metal rods, clothes hanger bars ANSI A156.16, L03131, of required length, full length of shelf.

2. Install vertical slotted shelf standards, ANSI A156.9, B04103 to studs with toggle bolts through each fastener opening. Double slotted shelf standards may be used where adjacent shelves terminate.
   a. Install brackets ANSI A156.9, B04113, providing supports for shelf not over 900 mm (36 inches) on center and within 13 mm (1/2 inch) of shelf end unless shown otherwise.
   b. Install shelves on brackets so front edge is restrained by bracket.

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SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

Formed sheet metal work for flashing and insulated expansion joint covers are specified in this section.

1.2 RELATED WORK

A. Sealant compound and installation: Section 07 92 00, JOINT SEALANTS.

B. Color of factory coated metal and anodized aluminum: Section 09 06 00, SCHEDULE FOR FINISHES.

C. Integral flashing component of manufactured roof specialties and accessories or equipment: Division 22, PLUMBING.

D. Paint materials and application: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:
Flashings

C. Manufacturer's Literature and Data:
Two-piece counterflashing
Nonreinforced, elastomeric sheeting

D. Certificates: Stating that aluminum has been given - specified finish.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below for a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A167-99(R 2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A653/A653M-07.....Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process

B32-04.....Solder Metal

B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate

B370-03.....Copper Sheet and Strip for Building Construction

D173-03.....Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing

D412-06.....Vulcanized Rubber and Thermoplastic Elastomers-Tension

D1187-97 (R2002).....Asphalt Base Emulsions for Use as Protective Coatings for Metal

D1784-07.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

D4586-07.....Asphalt Roof Cement, Asbestos Free

C. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI):

ES-1-2003.....Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual (2003 Edition).

E. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-505-88.....Metal Finishes Manual

F. American Architectural Manufacturers Association (AAMA):

605-98.....Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions Panels

G. Federal Specification (Fed. Spec):

A-A-1925A.....Shield, Expansion; (Nail Anchors)

UU-B-790A.....Building Paper, Vegetable Fiber

H. International Building Code (IBC):

2007 Edition

PART 2 - PRODUCTS

2.1 MATERIALS

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

B. Stainless Steel: ASTM A167, Type 302B, dead soft temper.

C. Galvanized Sheet: ASTM, A653.

D. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet

(0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

E. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m²(6 lbs/100 sf).

F. Bituminous Paint: ASTM D1187, Type I.

G. Fasteners:

1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
2. Nails:
   a. Minimum diameter for copper nails: 3 mm (0.109 inch).
   b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
   c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
   d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
3. Rivets: Not less than 3 mm (1/8 inch) diameter.
4. Expansion Shields: Fed Spec A-A-1925A.

H. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.

I. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

J. Roof Cement: ASTM D4586.

2.2 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:

B. Concealed Locations (Built into Construction):

1. Stainless steel: 0.25 mm (0.010 inch) thick.

C. Exposed Locations:

1. copper: 0.4 Kg (16 oz).
2. Stainless steel: 0.4 mm (0.015 inch).

2.3 FABRICATION, GENERAL

A. Jointing:

1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
3. Joints shall conform to following requirements:
   a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
   b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
   c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
4. Flat and lap joints shall be made in direction of flow.
5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
   a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
   b. Wire brush to produce a bright surface before soldering lead coated copper.
   c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
   d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.

3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:
1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:
1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.6 Kg (24 ounce) copper or 0.6 mm (0.024 inch) thick stainless steel.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1 Kg (32 oz) copper or 0.8 mm (0.031 inch) thick stainless steel.

E. Drips:
   1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
   2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:
   1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
   2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
   3. All metal roof edges shall meet requirements of IBC 2003.

G. Metal Options:
   1. Where options are permitted for different metals use only one metal throughout.
   2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.
   3. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

2.4 FINISH

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.

B. In accordance with NAAMM Metal Finishes Manual, unless otherwise specified.

C. Finish exposed metal surfaces as follows, unless specified otherwise:
   1. Copper: Mill finish.
   2. Stainless Steel: Finish No. 2B or 2D.
   3. Aluminum:
      a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
      b. Colored Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte,

integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.

c. Fluorocarbon Finish: AAMA 605, high performance organic coating.

d. Mill finish.

4. Steel and Galvanized Steel:

a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.

b. Manufacturer's finish:

1) Baked on prime coat over a phosphate coating.

2) Baked-on prime and finish coat over a phosphate coating.

3) Fluorocarbon Finish: AAMA 605, high performance organic coating.

2.5 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.

1. Use either copper, or stainless steel, thickness specified unless specified otherwise.

2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.

3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.

4. Use either copper, or stainless steel at pipe flashings.

B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).

C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.

D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

E. Pipe Flashing: (Other than engine exhaust or flue stack)

1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.

2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.

3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
   a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
   b. Allow for loose fit around and into the pipe.
4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
   a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
   b. Allow for loose fit around pipe.

2.6 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Either copper or stainless steel, unless specified otherwise.

B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
   1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
   2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
   3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
   4. Manufactured assemblies may be used.
   5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
   6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. One-piece Counterflashing:
   1. Back edge turned up and fabricate to lock into reglet in concrete.
   2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Two-Piece Counterflashing:
   1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
   2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:
   1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.

2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:
1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.

4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.

b. Paint dissimilar metal with a coat of bituminous paint.

c. Apply an approved caulking material between aluminum and dissimilar metal.

15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.

16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

17. Bitumen Stops:

a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.

b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.

1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.

2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.

3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.

4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

C. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

D. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.3 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:
1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.
   a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      1) Locate fasteners in masonry mortar joints.
      2) Use screws to sheet metal or wood.
   b. Fill joint at top with sealant.
4. Where flashing or hood is mounted on pipe.
   a. Secure with draw band tight against pipe.
   b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
   c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:

a. Secure to face construction in accordance, with manufacturers instructions.

b. Completely fill space at the top edge of receiver with sealant.

3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counter flashing is a component of other flashing install as shown.

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SECTION 07 81 00
APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies mineral fiber and cementitious coverings to provide fire resistance to interior structural steel members shown.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Manufacturer's complete and detailed application instructions and specifications.
2. Manufacturer's repair and patching instructions.

C. Certificates:

1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
   a. List thickness and density of material required to meet fire ratings.
   b. Accompanied by complete test report and test record.
2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.

D. Miscellaneous:

1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
2. Manufacturer's written approval of completed installation.
3. Manufacturer's written approval of the applicators of fireproofing material.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and certification of compliance with the specified requirements.

B. Remove damaged containers from the site.

C. Store the materials off the ground, under cover, away from damp surfaces.

D. Keep dry until ready for use.

E. Remove materials that have been exposed to water before installation from the site.

1.4 QUALITY CONTROL

A. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.

B. Manufacturer's inspection and approval of surfaces to receive fireproofing as specified under paragraph Examination.

C. Manufacturer's approval of fireproofing applications.

D. Manufacturer's approval of completed installation.

E. Manufacturer's representative shall observe and advise at the commencement of application, and shall visit the site as required thereafter for the purpose of ascertaining proper application.

F. Pre-Application Test Area.

1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
   a. Apply to one column.
   b. Apply for the hourly ratings used.
2. Install in location selected by the Resident Engineer, for approval by the representative of the fireproofing material manufacturer and by the Government.
3. Perform Bond test on painted steel in accordance with ASTM E736.
4. Do not proceed in other areas until installation of test area has been completed and approved.
5. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

C841-03.....Installation of Interior Lathing and Furring
C847-06.....Metal Lath
E84-08.....Surface Burning Characteristics of Building Materials
E119-08.....Fire Tests of Building Construction and Materials

E605-93 (R2006).....Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members

E736-00.....Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

E759-92 (R2005).....The Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members

E760-92 (R2005).....Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members

E761-92 (R2005).....Compressive Strength of Fire-Resistive Material Applied to Structural Members

E859-93 (R2006).....Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members

E937-93 (R2005).....Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members

E1042-02.....Acoustically, Absorptive Materials Applied by Trowel or Spray.

G21-96 (R2002).....Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory...Latest Edition including Supplements

D. Warnock Hersey (WH):
Certification Listings..Latest Edition

E. Factory Mutual System (FM):
Approval Guide.....Latest Edition including Supplements

PART 2 - PRODUCTS

2.1 SPRAYED-ON FIREPROOFING

A. ASTM E1042, Class (a), Category A.
   1. Type I, factory mixed cementitious materials with approved aggregate.
   2. Type II, factory mixed mineral fiber with integral inorganic binders minimum 240 kg/m^3 (15 1b/ft^3) density per ASTM E605 test unless specified otherwise. Use in areas that are completely encased.

B. Materials containing asbestos are not permitted.

C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf/ft^2) for protected areas. 19.15 kPa (400 lbf/ft^2) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27gm/m^2 (0.025 gm/ft^2).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 36 kPa (5 lbf/in^2).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

2.2 ADHESIVE

A. Bonding adhesive for Type II (fibrous) materials as recommended and supplied by the fireproofing material manufacturer.

B. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

2.3 SEALER

A. Sealer for Type II (fibrous) material as recommended and supplied by the fireproofing material manufacturer.

B. Surface burning characteristics as specified for fireproofing material.

C. Fungus resistant.

D. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

2.4 WATER

A. Clean, fresh, and free from organic and mineral impurities.

B. pH of 6.9 to 7.1.

2.5 MECHANICAL BOND MATERIAL

A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg/m^2 (1.7 pounds per square yard).

B. Fasteners: ASTM C841.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.

B. Verify hangers, inserts and clips are installed before the application of fireproofing material.

C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.

D. Verify concrete work on steel decking and concrete encased steel is completed.

E. Verify temperature and enclosure conditions are required by fire-proofing material manufacturer.

3.2 APPLICATION

A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.

B. Coordinate application of fireproofing material with other trades.

C. Application of Metal Lath:

1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
2. Apply to beam flanges 300 mm (12-inches) or more in width.
3. Apply to column flanges 400 mm (16-inches) or more in width.
4. Apply to beam or column web 400 mm (16-inches) or more in depth.
5. Tack weld or mechanically fasten on maximum of 300 mm (12-inch) center.
6. See design criteria section of the approved assemblies used.
7. Lap and tie lath member in accordance with ASTM C841.

D. Mix and apply in accordance with manufacturer's instructions.

1. Mechanically control material and water ratios.
2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
4. Minimum applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purl in or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms shall be as follows:
   a. Type I - 240 kg/m^3 (15 lb/ft^3).
   b. Type II - 350 kg/m^3 (22 lb/ft^3).

E. Application shall be completed in one area, inspected and approved by Resident Engineer before removal of application equipment and proceeding with further work.

3.3 FIELD TESTS

A. Tests of applied material will be performed by VA retained Testing Laboratory. See Section 01 45 29, TESTING LABORATORY SERVICES.

B. Resident Engineer will select area to be tested in specific bays on each floor using a geometric grid pattern.

C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test will be rejected.

D. Areas showing less than required fireproofing characteristics will be rejected on the following field tests.
   1. Test for cohesion/adhesion: ASTM E736.
   2. Test for bond impact strength: ASTM E760.

3.3 PATCHING AND REPAIRING

A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.

B. Perform corrective measures in accordance with fireproofing material Manufacturer's recommendations.
   1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
   2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.

3. Hand mixing of material is not permitted.

C. Repair:

1. Respray all test and rejected areas.
2. Patch fireproofing material which is removed or disturbed after approval.

D. Perform final inspection of sprayed areas after patching and repair.

3.5 SCHEDULE

A. Apply fireproofing material in interior structural steel members, except on following surfaces:

1. Areas used as air handling plenums.
4. Steel to be encased in concrete or designated to receive other type of fireproofing.

B. Type I:

1. One hour fire rating.
2. Two hour fire rating.
3. Three hour fire rating.

C. Type II:

1. One hour fire rating.
2. Two hour fire rating.

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SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.1 DESCRIPTION

A. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.

B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

A. Spray applied fireproofing: Section 07 81 00, APPLIED FIREPROOFING

B. Sealants and application: Section 07 92 00, JOINT SEALANTS.

C. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.

C. List of FM, UL, or WH classification number of systems installed.

D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

1.4 DELIVERY AND STORAGE

A. Deliver materials in their original unopened containers with manufacturer’s name and product identification.

B. Store in a location providing protection from damage and exposure to the elements.

1.5 WARRANTY

Firestopping work subject to the terms of the Article “Warranty of Construction”, FAR clause 52.246-21, except extend the warranty period to five years.

1.6 QUALITY ASSURANCE

FM, UL, or WH or other approved laboratory tested products will be acceptable.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

E84-07.....Surface Burning Characteristics of Building Materials

E814-06.....Fire Tests of Through-Penetration Fire Stops

C. Factory Mutual Engineering and Research Corporation (FM):

Annual Issue Approval Guide Building Materials

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

Annual Issue Fire Resistance Directory

1479-03.....Fire Tests of Through-Penetration Firestops

E. Warnock Hersey (WH):

Annual Issue Certification Listings

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.

B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m^2 (16 sq. in.) in overall cross sectional area.

C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.

D. Firestop sealants used for firestopping or smoke sealing shall have following properties:

1. Contain no flammable or toxic solvents.
2. Have no dangerous or flammable out gassing during the drying or curing of products.

3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
1. Classified for use with the particular type of penetrating material used.
2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.

F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.

G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

H. Materials to be asbestos free.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.

B. Use mineral fiber filler and bond breaker behind sealant.

C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with E84.

D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

3.2 PREPARATION

A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.

B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

3.3 INSTALLATION

A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.

B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.

C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP AND ACCEPTANCE OF WORK

A. As work on each floor is completed, remove materials, litter, and debris.

B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the Resident Engineer.

C. Clean up spills of liquid type materials.

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK:

A. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.

B. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.

C. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.3 QUALITY CONTROL:

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI’s Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.

1.4 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's installation instructions for each product used.

C. Cured samples of exposed sealants for each color where required to match adjacent material.

D. Manufacturer's Literature and Data:

1. Caulking compound
2. Primers
3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 PROJECT CONDITIONS:

A. Environmental Limitations:

1. Do not proceed with installation of joint sealants under following conditions:
   a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
   b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 DELIVERY, HANDLING, AND STORAGE:

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 5° C (40° F) or less than 32° C (90° F).

1.7 DEFINITIONS:

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Back-up Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.8 WARRANTY:

A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.

B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material.

C612-04.....Mineral Fiber Block and Board Thermal Insulation.

C717-07.....Standard Terminology of Building Seals and Sealants.

C834-05.....Latex Sealants.

C919-02.....Use of Sealants in Acoustical Applications.

C920-05.....Elastomeric Joint Sealants.

C1021-08.....Laboratories Engaged in Testing of Building Sealants.

C1193-05.....Standard Guide for Use of Joint Sealants.

C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

D1056-07.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.

E84-08.....Surface Burning Characteristics of Building Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS:

A. S-1:
1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40

B. S-2:
1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade P.
5. Shore A hardness of 25-40.

C. S-3:
1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-25.
6. Minimum elongation of 700 percent.

D. S-4:
1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

E. S-5:
1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

F. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.
6. Minimum elongation of 1200 percent.

G. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

H. S-8:

1. ASTM C920, silicone, acetoxy cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.

J. S-10:

1. ASTMC C920, coal tar extended fuel resistance polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 15-20.

K. S-11:

1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.

4. Grade P/NS.
5. Shore A hardness of 35 to 50.

L. S-12:
1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to 50.

2.2 CAULKING COMPOUND:

A. C-1: ASTM C834, acrylic latex.

B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.3 COLOR:

A. Sealants used with exposed masonry shall match color of mortar joints.

B. Sealants used with unpainted concrete shall match color of adjacent concrete.

C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.

D. Caulking shall be light gray or white, unless specified otherwise.

2.4 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid,

inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER:

A. Mineral fiber board: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

2.7 CLEANERS-NON POUROUS SURFACES:

Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

A. Prepare joints in accordance with manufacturer's instructions and SWRI.

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.

1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

a. Concrete.

b. Masonry.

c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

a. Metal.

b. Glass.

c. Porcelain enamel.

d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.

1. Apply primer prior to installation of back-up rod or bond breaker tape.

2. Use brush or other approved means that will reach all parts of joints.

F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION:

A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.

D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY:

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.

3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL:

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
   1. Extent of Testing: Test completed elastomeric sealant joints as follows:
      a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
      b. Perform one test for each 300 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
C. Inspect tested joints and report on following:
   1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
   2. Compare these results to determine if adhesion passes sealant manufacturer’s field-adhesion hand-pull test criteria.
   3. Whether sealants filled joint cavities and are free from voids.
   4. Whether sealant dimensions and configurations comply with specified requirements.
D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING:

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.

B. After filling and finishing joints, remove masking tape.

C. Leave adjacent surfaces in a clean and unstained condition.

3.8 LOCATIONS:

A. Exterior Building Joints, Horizontal and Vertical:

1. Metal to Metal: Type S-1, S-2
2. Metal to Masonry or Stone: Type S-1
3. Masonry to Masonry or Stone: Type S-1
4. Stone to Stone: Type S-1
5. Cast Stone to Cast Stone: Type S-1
6. Threshold Setting Bed: Type S-1, S-3, S-4
7. Masonry Expansion and Control Joints: Type S-6
8. Wood to Masonry: Type S-1

B. Metal Reglets and Flashings:

1. Flashings to Wall: Type S-6
2. Metal to Metal: Type S-6

C. Sanitary Joints:

1. Walls to Plumbing Fixtures: Type S-9
2. Counter Tops to Walls: Type S-9
3. Pipe Penetrations: Type S-9

D. Interior Caulking:

1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.

2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2 and C-3.
3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2 and C-3.
4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Types C-1, C-2 and C-3.
5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
7. Concealed Acoustic Sealant Type S-4, C-1, C-2 and C-3.

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies steel doors, steel frames and related components.

B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

1.2 RELATED WORK

A. Door Hardware: Section 08 71 00, DOOR HARDWARE.

B. Glazing: Section 08 80 00, GLAZING.

1.3 TESTING

An independent testing laboratory shall perform testing.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers Literature and Data:

1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements.
2. Sound rated doors, including test report from Testing Laboratory.

1.5 SHIPMENT

A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.

B. Fasten temporary steel spreaders across the bottom of each door frame.

1.6 STORAGE AND HANDLING

A. Store doors and frames at the site under cover.

B. Protect from rust and damage during storage and erection until completion.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

L-S-125B.....Screening, Insect, Nonmetallic

C. Door and Hardware Institute (DHI):

A115 Series.....Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)

D. Steel Door Institute (SDI):

113-1979.....Apparent Thermal Performance for Steel Door and Frame Assemblies

114-1979.....Acoustical Performance for Steel Door and Frame Assemblies

A250.8-98.....Standard Steel Doors and Frames

E. American Society for Testing and Materials (ASTM):

A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A568/568-M-07.....Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled

A1008-07.....Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability

B209/209M-09.....Aluminum and Aluminum-Alloy Sheet and Plate

B221/221M-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes

D1621-04.....Compressive Properties of Rigid Cellular Plastics

D3656-04.....Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns

E90-04.....Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

F. The National Association Architectural Metal Manufactures (NAAMM):

Metal Finishes Manual (1988 Edition)

G. National Fire Protection Association (NFPA):

80-08.....Fire Doors and Fire Windows

H. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory

I. Intertek Testing Services (ITS):

Certifications Listings…Latest Edition

J. Factory Mutual System (FM):

Approval Guide

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.

B. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.

C. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

2.2 FABRICATION GENERAL

A. GENERAL:

1. Follow SDI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per SDI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
2. Close top edge of exterior doors flush and seal to prevent water intrusion.
3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.

B. Standard Duty Doors: SDI A250.8, Level 1, Model 2 of size and design shown. Use for interior locations only. Do not use for stairwell doors, security doors and detention doors.

C. Heavy Duty Doors: SDI A250.8, Level 2, Model 2 of size and design shown. Core construction types a, d, or f, for interior doors, and, types b, c, e, or f, for exterior doors.

D. Smoke Doors:

1. Close top and vertical edges flush.
2. Provide seamless vertical edges.
3. Apply Steel astragal to the meeting style at the active leaf of pair of doors or double egress doors.
4. Provide clearance at head, jamb and sill as specified in NFPA 80.

E. Fire Rated Doors (Labeled):

1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
2. Fire rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
3. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit

devices are specified for both leaves swinging in the same direction.

4. Construct fire rated doors in stairwell enclosures for maximum transmitted temperature rise of 230 °C (450 °F) above ambient temperature at end of 30 minutes of fire exposure when tested in accordance with ASTM E152.

F. Custom Metal Hollow Doors:

1. Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design, materials, construction, gages and finish shall be as specified for of standard steel doors.

2.3 METAL FRAMES

A. General:

1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for exterior doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
3. Frames for labeled fire rated doors.
   a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual.
   b. Fire rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements. Provide labels of metal or engraved stamp, with raised or incised markings.
4. Frames for doors specified to have automatic door operators; Security doors (Type 36); service window: minimum 1.7 mm (0.067 inch) thick.
5. Knocked-down frames are not acceptable.

B. Reinforcement and Covers:

1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements except on lead-lined frames.

C. Glazed Openings:

a. Integral stop on exterior, corridor, or secure side of door.

b. Design rabbet width and depth to receive glazing material or panel shown or specified.

D. Frame Anchors:

1. Floor anchors:

a. Where floor fills occur, provide extension type floor anchors to compensate for depth of fill.

b. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts. Use 50 mm x 50 mm (2 inch by 2 inch) 9 mm by (3/8 inch) clip angle for lead lined frames, drilled for 9 mm (3/8 inch) floor bolts.

c. Where mullions occur, provide 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two 6 mm (1/4 inch) floor bolts and frame anchor screws.

d. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts and frame anchor screws. Space floor bolts at 50 mm (24 inches) on center.

2. Jamb anchors:

a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.

b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.

c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:

1) Wire loop type of 5 mm (3/16 inch) diameter wire.

2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.

d. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.

e. Anchors for frames set in prepared openings:

1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.

f. Anchors for observation windows and other continuous frames set in stud partitions.
1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
2) Anchors spaced 600 mm (24 inches) on centers maximum.

g. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

2.4 SHOP PAINTING

SDI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Plumb, align and brace frames securely until permanent anchors are set.
1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
3. Protect frame from accidental abuse.
4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

B. Floor Anchors:
1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
2. Power actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
3. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
4. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers. Secure two piece frames to subframe or rough buck with machine screws on both faces.

D. Install anchors for labeled fire rated doors to provide rating as required.

E. Frames for Sound Rated Doors: Coordinate to line frames for sound rated doors with insulation.

F. Overhead Bracing (Lead Lined Frames): Where jamb extensions extend to structure above, anchor clip angles with not less than two, 9 mm (3/8 inch) expansion bolts or power actuated drive pins to concrete slab. Weld to steel overhead members.

3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

Install doors and hardware as specified in Sections 08 11 13, HOLLOW METAL DOORS AND FRAMES Section 08 14 00, WOOD DOORS Section 08 71 00, DOOR HARDWARE.

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SECTION 08 14 00
INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior flush doors with prefinish, prefit option.

B. Section includes fire rated doors, sound retardant doors, and smoke.

1.2 RELATED WORK

A. Metal door frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.

B. Door hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.

C. Installation of doors and hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 14 00, WOOD DOORS, or Section 08 71 00, DOOR HARDWARE.

D. Glazing: Section 08 80 00, GLAZING.

E. Finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

2. Veneer sample 200 mm (8 inch) by 275 mm (11 inch) by 6 mm (1/4 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.

C. Shop Drawings:

1. Show every door in project and schedule location in building.
2. Indicate type, grade, finish and size; include detail of glazing and pertinent details.
3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.

D. Manufacturer's Literature and Data:

1. Labeled fire rated doors showing conformance with NFPA 80.

E. Laboratory Test Reports:

1. Screw holding capacity test report in accordance with WDMA TM-10.
2. Split resistance test report in accordance with WDMA TM-5.
3. Cycle/Slam test report in accordance with WDMA TM-7.
4. Hinge-Loading test report in accordance with WDMA TM-8.

1.4 WARRANTY

A. Doors are subject to terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty shall be as follows:

1. For interior doors, manufacturer's warranty for lifetime of original installation.

1.5 DELIVERY AND STORAGE

A. Factory seal doors and accessories in minimum of 6 mill polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.

B. Store in accordance with WDMA I.S.1-A, J-1 Job Site Information.

C. Label package for door opening where used.

1.6 APPLICABLE PUBLICATIONS

Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. Window and Door Manufacturers Association (WDMA):

I.S.1-A-04.....Architectural Wood Flush Doors
I.S.4-00.....Water-Repellent Preservative Non-Pressure Treatment for Millwork
I.S.6-97.....Wood Stile and Rail Doors
I.S.6-A-01.....Architectural Stile and Rail Doors
TM-5-90.....Test Method to Determine the Split Resistance of Stile Edges of Wood Doors
TM-6-88.....Adhesive Bond Durability Test Method
TM-7-90.....Cycle-Slam Test Method
TM-8-90.....Hinge Loading Resistance Test Method
TM-10-90.....Screw Holding Test Method

C. National Fire Protection Association (NFPA):

80-99.....Fire Doors and Windows
252-03.....Fire Tests of Door Assemblies

D. ASTM International (ASTM):

E90-00.....Fire Tests of Door Assemblies

PART 2 - PRODUCTS

2.1 FLUSH DOORS

A. General:

1. Meet requirements of WDMA I.S.1-A, Extra Heavy Duty.
2. Adhesive: Type II
3. Thickness: 45 mm (1-3/4 inches) unless otherwise shown or specified.

B. Face Veneer:
1. In accordance with NWWDA I.S.1-A.
2. One species throughout the project unless scheduled or otherwise shown.
3. For transparent finishes: Premium Grade. Cut and species to match existing.
   a. Match face veneers for doors for uniform effect of color and grain at joints.
   b. Door edges shall be same species as door face veneer except maple may be used for stile face veneer on birch doors.
   c. In existing buildings, where doors are required to have transparent finish, use wood species and grade of face veneers to match adjacent existing doors.
4. For painted finishes: Custom Grade, mill option close grained hardwood, premium or medium density overlay. Do not use Lauan.
5. Factory sand doors for finishing.

C. Wood for stops, louvers, muntins and moldings of flush doors required to have transparent finish:
1. Solid Wood of same species as face veneer, except maple may be used on birch doors.
2. Glazing:
   a. On non-labeled doors use applied wood stops nailed tight on room side and attached on opposite side with flathead, countersunk wood screws, spaced approximately 125 mm (5 inches) on centers.
   b. Use stainless steel or dull chrome plated brass screws for exterior doors.

D. Fire rated wood doors:
1. Fire Performance Rating:
   a. “B” label, 1-1/2 hours.
   b. “C” label, 3/4 hour.
2. Labels:
   a. Doors shall conform to the requirements of ASTM E2074, or NFPA 252, and, carry an identifying label from a qualified testing and

inspection agency for class of door or opening shown designating fire performance rating.

b. Metal labels with raised or incised markings.

3. Performance Criteria for Stiles of doors utilizing standard mortise leaf hinges:
   a. Hinge Loading: WDMA TM-8. Average of 10 test samples for Extra Heavy Duty doors.
   b. Direct screw withdrawal: WDMA TM-10 for Extra Heavy Duty doors. Average of 10 test samples using a steel, fully threaded #12 wood screw.
   c. Cycle Slam: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with WDMA TM-7.
4. Additional Hardware Reinforcement:
   a. Provide fire rated doors with hardware reinforcement blocking.
   b. Size of lock blocks as required to secure hardware specified.
   c. Top, bottom and intermediate rail blocks shall measure not less than 125 mm (five inches) minimum by full core width.
   d. Reinforcement blocking in compliance with manufacturer's labeling requirements.
   e. Mineral material similar to core is not acceptable.
5. Other Core Components: Manufacturer's standard as allowed by the labeling requirements.
6. Provide steel frame approved for use in labeled doors for vision panels.
7. Provide steel astragal on pair of doors.

E. Smoke Barrier Doors:
1. For glazed openings use steel frames approved for use in labeled doors.
2. Provide a steel astragal on one leaf of pairs of doors, including double egress doors.

2.2 PREFINISH, PREFIT OPTION

A. Flush doors may be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.

B. Factory fitting to conform to specification for shop and field fitting, including factory application of sealer to edge and routings.

C. Flush doors to receive transparent finish (in addition to being prefit) shall be factory finished as follows:
   1. WDMA I.S.1A Section F-3 specification for System TR-4, Conversion Varnish or System TR-5, Catalyzed Vinyl.
   2. Use stain when required to produce the finish specified in Section 09 06 00 SHEDULE FOR FINISHES.

2.3 IDENTIFICATION MARK:

A. On top edge of door.
B. Either a stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, code date of manufacture and quality.
C. Accompanied by either of the following additional requirements:
   1. An identification mark or a separate certification including name of inspection organization.
   2. Identification of standards for door, including glue type.
   3. Identification of veneer and quality certification.
   4. Identification of preservative treatment for stile and rail doors.

2.4 SEALING:

Give top and bottom edge of doors two coats of catalyzed polyurethane or water resistant sealer before sealing in shipping containers.

PART 3 - EXECUTION

3.1 DOOR PREPARATION

A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire rated doors.
B. Clearances between Doors and Frames and Floors:
   1. Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.
   2. Maximum clearance at bottom of sound rated doors, light-proofed doors, doors to operating rooms, and doors designated to be fitted with mechanical seal: 10 mm (3/8 inch).
C. Provide cutouts for special details required and specified.
D. Rout doors for hardware using templates and location heights specified in Section, 08 71 00 DOOR HARDWARE.
E. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (two inches) of door thickness, undercut where shown.

F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.

G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.

H. Apply a steel astragal on the opposite side of active door on pairs of fire rated doors.

I. Apply a steel astragal to meeting style of active leaf of pair of doors or double egress smoke doors.

3.2 INSTALLATION OF DOORS APPLICATION OF HARDWARE

Install doors and hardware as specified in Section, INSTALLATION OF DOORS AND HARDWARE.

3.3 DOOR PROTECTION

A. As door installation is completed, place polyethylene bag or cardboard shipping container over door and tape in place.

B. Provide protective covering over knobs and handles in addition to covering door.

C. Maintain covering in good condition until removal is approved by Resident Engineer.

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SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies access doors or panels.

1.2 RELATED WORK:

A. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.

C. Access doors in acoustical ceilings: Section 09 51 00, ACOUSTICAL CEILINGS.

D. Locations of access doors for duct work cleanouts: Section 23 31 00, HVAC DUCTS AND CASINGS, Section 23 37 00, AIR OUTLETS AND INLETS .

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Access doors, each type, showing construction, location and installation details.

C. Manufacturer's Literature and Data: Access doors, each type.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Society for Testing and Materials (ASTM):

A167-99(R-2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A1008-07.....Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy

C. American Welding Society (AWS):

D1.3-98.....Structural Welding Code Sheet Steel

D. National Fire Protection Association (NFPA):

80-06.....Fire Doors and Windows

E. The National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series.....Metal Finishes Manual

F. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

A. Fabricate components to be straight, square, flat and in same plane where required.
   1. Slightly round exposed edges and without burrs, snags and sharp edges.
   2. Exposed welds continuous and ground smooth.
   3. Weld in accordance with AWS D1.3.

B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. For fire rated doors, use hinges and locks as required by fire test.

C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening. Provide anchors as required by fire test.

2.2 ACCESS DOORS, FIRE RATED:

A. Shall meet requirements for "B" label 1-1/2 hours with maximum temperature rise of 120 degree C (250 degrees F).

B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for Class B opening.

C. Door Panel: Form of 0.9 mm (0.0359 inch) thick steel sheet, insulated sandwich type construction.

D. Frame: Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.
   1. Weld exposed joints in flange and grind smooth.
   2. Provide frame flange at perimeter where installed in concrete masonry or gypsum board.

E. Automatic Closing Device: Provide automatic closing device for door.

F. Hinge: Continuous steel hinge with stainless steel pin.

G. Lock:
   1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
   2. Provide latch release device operable from inside of door. Mortise case in door.

2.3 ACCESS DOORS, FLUSH PANEL:

A. Door Panel:
   1. Form of 1.9 mm (0.0747 inch) thick steel or 1.5 mm (0.0598 inch) thick stainless steel sheet.
   2. Reinforce to maintain flat surface.

B. Frame:
   1. Form of 1.5 mm (0.0598 inch) thick steel or stainless steel sheet of depth and configuration to suit material and type of construction where installed.
   2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
   3. Weld exposed joints in flange and grind smooth.

C. Hinge:
   1. Concealed spring hinge to allow panel to open 175 degrees.
   2. Provide removable hinge pin to allow removal of panel from frame.

D. Lock:
   1. Flush, screwdriver operated cam lock.

2.4 ACCESS DOOR, RECESSED PANEL:

A. Door Panel:
   1. Form of 1.2 mm (0.0478 inch) thick steel or stainless steel sheet to form a 25 mm (one inch) deep recessed pan to accommodate the installation of acoustical units or other materials where shown in walls and ceiling.
   2. Reinforce as required to prevent sagging.

B. Frame:
   1. Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit installation in suspension system of ceiling or wall framing.
   2. Extend sides of frame to protect edge of acoustical units when panel is in open position.
   3. Provide shims, bushings, clips and other devices necessary for installation.

C. Hinge: Continuous steel hinge with stainless steel pin or concealed hinge.

D. Lock:
   1. Flush screwdriver operated cam lock.

2. Provide sleeve of plastic or stainless steel grommet to protect hole made in acoustical unit for screwdriver access to lock.

2.5 FINISH:

A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.

B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.

C. Stainless Steel: No. 4 for exposed surfaces.

2.6 SIZE:

Minimum 600 mm (24 inches) square door unless otherwise shown or required to suit opening in suspension system of ceiling.

PART 3 - EXECUTION

3.1 LOCATION:

A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.

B. Use fire rated doors in fire rated partitions and ceilings.

C. Use flush panels in partitions and gypsum board or plaster ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

D. Use Stainless Steel at wet locations.

3.2 INSTALLATION, GENERAL:

A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.

B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.

C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.

D. Set recessed panel access doors recessed so that face of surrounding materials will finish on the same plane, when finish in door is installed.

3.3 ANCHORAGE:

A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.

B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.

C. Anchors for fire rated access doors shall meet requirements of applicable fire test.

3.4 ADJUSTMENT:

A. Adjust hardware so that door panel will open freely.

B. Adjust door when closed so door panel is centered in the frame.

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

Door hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

A. Caulking: Section 07 92 00 JOINT SEALANTS.

B. Application of Hardware: Section 08 14 00, WOOD DOORS Section 08 11 13, HOLLOW METAL DOORS AND FRAMES

C. Finishes: Section 09 06 00, SCHEDULE FOR FINISHES.

D. Painting: Section 09 91 00, PAINTING.

1.3 GENERAL

A. All hardware shall comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.

B. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.

C. Deadlocks specified for psychiatric area doors are not required to have "UL" label.

D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.

E. Provide SARGuard/MicroShield antimicrobial clear powder coat on all hardware metal components.

F. The following items shall be of the same manufacturer, if possible, except as otherwise specified:

1. Mortise locksets.
2. Hinges for hollow metal and wood doors.
3. Surface applied overhead door closers.
4. Exit devices.
5. Floor closers.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

C. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

1.5 DELIVERY AND MARKING

Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to Resident Engineer for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in Resident Engineer's office until all

other similar items have been installed in project, at which time the Resident Engineer will deliver items on file to Contractor for installation in predetermined locations on the project.

1.6 INSTRUCTIONS

A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters "HW" followed by a number. Each number designates a set of hardware items applicable to a door type.

B. Manufacturers' Catalog Number References: Where manufacturers' products are specified herein, products of other manufacturers which are considered equivalent to those specified may be used. Manufacturers whose products are specified are identified by abbreviations as follows:

Adams-Rite	Adams Rite Mfg. Co.	Glendale, CA
Glynn Johnson	Glynn Johnson Co.	Chicago, IL
LCN	LCN Closers	Princeton, IL
Firemark	Rixon-Firemark Co.	Chicago, IL
Hager	Hager Hinge Company	Saint Louis, MO
Stanley	The Stanley Works	New Britain, CT
Trimco	Triangle Brass Mfg. Co.	Los Angeles, CA
Unican	Simplex Security Systems	Collinsville, CT
Von Duprin	Von Duprin Hardware Co.	Indianapolis, IN
Zero	Zero Weather Stripping Co.	New York, NY

C. Keying: All cylinders shall be keyed into existing system, coordinate with Resident Engineer. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be pin type to match existing. Keying information shall be furnished at a later date by the Resident Engineer.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by

series, types, etc., listed in such specifications and standards, except as otherwise specified.

B. American Society for Testing and Materials (ASTM):

F883-04.....Padlocks

C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):

A156.1-00.....Butts and Hinges

A156.2-03.....Bored and Pre-assembled Locks and Latches

A156.3-01.....Exit Devices

A156.4-00.....Door Controls (Closers)

A156.5-01.....Auxiliary Locks and Associated Products

A156.6-05.....Architectural Door Trim

A156.8-05.....Door Controls-Overhead Stops and Holders

A156.13-05.....Mortise Locks and Latches Series 1000

A156.15-06.....Release Devices-Closer Holder, Electromagnetic and Electromechanical

A156.16-02.....American National Standard for Auxiliary Hardware

A156.18-00.....Materials and Finishes

A156.21-06.....Thresholds

A156.22-05.....Door Gasketing and Edge Seal Systems

A156.23-04.....Electromagnetic Locks

A156.24-03.....Delayed Egress Locking Systems

A156.26-00.....Continuous Hinges

A156.31 .....American National Standard for Electric Strikes and Frame Mounted Actuators

A250.8-03.....Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):

80-06.....Fire Doors and Fire Windows

101-05.....Life Safety Code

E. Underwriters Laboratories, Inc. (UL):

Building Materials Directory (2007)

PART 2 - PRODUCTS

2.1 BUTT HINGES

A. ANSI A156.1. The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:
   1. Interior Doors: Type 8112 for doors 900 mm (3 feet) wide or less and Type A8111 for doors over 900 mm (3 feet) wide.
   2. Labeled Wood Fire Doors: Type 8411 or Type 8412; these hinges shall be thru bolted to door with hex nuts and bolts.

B. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

2.3 DOOR CLOSING DEVICES

Closing devices shall be products of one manufacturer for each type specified.

2.4 OVERHEAD CLOSERS

A. Conform to ANSI A156.4, Grade 1.

B. Closers shall conform to the following:
   1. The closer shall have 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
   2. Where specified, closer shall have hold-open feature.
   3. Size Requirements: Size closers in accordance with manufacturer's recommendations or provide multi-size closers, sizes 1 through 6.
   4. Material of closer shall be cast aluminum.
   5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
   6. Closers shall have full size cover.
   7. Closers shall have adjustable hydraulic back-check and separate valves for closing and latching speed.

2.5 COMBINATION CLOSER - HOLDER

A. Conform to ANSI A156.15; combination closer-holder with built-in electronic release.

B. Combination closer-holder shall have the following features:
   1. Control door closing and latching sequence by hydraulic action.
   2. Wiring for 24V DC current. Current draw shall not exceed 0.16 amperes.

3. Double level arm closing action, and adjustable hydraulic back-check.
4. Spring power for closing force shall conform to ANSI A156.4 and have 50% spring power adjustment.
5. Closer Size Requirements:
   a. Doors, 900 mm (3 feet) and less in width: Size III closer.
   b. Doors over 900 mm (3 feet) and less than 1050 mm (3 feet 6 inches) in width: Size IV closer.
   c. Doors 1050 mm (3 feet 6 inches) and over in width: Size V closer.
6. Hold open mechanism shall hold door open between 85 degrees and 180 degrees depending on wall and frame conditions. Mount device to provide maximum door opening permitted by building construction or equipment.
7. Electronic release shall release door when signaled by smoke detector. Smoke detectors shall not be incorporated as an integral part of door holders. Smoke detectors are specified in the ELECTRICAL Section.
8. All closers to have full covers.
9. All closers shall have a 1 ½" piston and an adjustable back check position valve.

2.6 DOOR STOPS

A. Conform to ANSI A156.16.
B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
D. Substitute floor stops Type L02141 or L02161 as appropriate, when wall bumpers would not provide an effective door stop.
E. Where drywall partitions occur, use floor stops, Type L02141 or L02161.
F. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.
G. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.

H. Provide door stops on doors where combination closer magnetic holders are specified.

2.7 LOCKS AND LATCHES

A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than number of pins of the existing lock sets. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw. Provide temporary keying device or construction core of allow opening and closing during construction and prior to the installation of final cores.

B. In addition to above requirements, locks and latches shall comply with following requirements:

1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise Locksets shall be manufactured by SARGENT Manufacturing Corporation Series 8200, New Haven, CT. All lockset functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. The case shall be closed on all sides and back. Lockset shall be 2 3/4” (70 mm) backset, standard, with a one piece 3/4” (19 mm) throw anti-friction stainless steel latch bolt. The deadbolt shall be a full 1” (25mm) throw made of stainless steel and have 2 hardened steel roller inserts. All locksets and latchsets shall have lever handles similar to Falcon S-lever Design. Lever handle shall be fabricated from wrought stainless steel. No substitute lever design or material shall be accepted. Strikes shall be non-handed with a curved lip. To insure proper alignment, all trim, knobs, or levers, shall be thru-bolted and fully interchangeable between rose and escutcheon designs. Mortise lockset shall have a field-adjustable, beveled armored front, with a .125” -1/8” (3mm) thickness minimum.

2. Cores: All cores to be Yale Replaceable 6-pin IC. Finish to be stainless steel. Cores to be compatible with Sargent and Yale hardware.
3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.5.

2.8 KEYS

A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	**Quantity**
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	1 key

2.9 KEY CABINET

A. ANSI Standard A156.5. Provide key cabinet made of cold rolled, 1.2 mm (0.0478 inch) thick furniture steel electro-welded. Doors shall have "no sag" continuous brass-pin piano type hinge and be equipped with chrome plated locking door handles, hook cam and two parasentric keys. All locks shall be nickel plated with solid brass pin tumbler cylinder keyed as directed. Key Cabinet and Key Control System shall accommodate all keys for this project plus 25 percent.

B. Key tags shall consist of two sets: Permanent self-locking and loan key snaphook type with tag colors as follows: Red fiber marker of the permanent self-locking type approximately 32 mm (1-1/4 inch) in diameter engraved with the legend "FILE KEY MUST NOT BE LOANED." Also furnish for each hook a white cloverleaf key marker with snap-hooks engraved with the legend "LOAN KEY."

C. The manufacturer of the lock cylinders and locks shall attach a key tag to keys of each lock cylinder and shall mark thereon the respective item number and key change number. Provide each group of keys in a key gathering envelope (supplied by Key Cabinet Manufacturer) in which the lock manufacturer shall include the following information: Item number,

key change number and door number. The contractor shall furnish the Key Cabinet Manufacturer the hardware and keying schedules and change keys.

D. The Key Cabinet Manufacturer shall set up a three-way cross index system, including master keys, listing the keys alphabetically, the hooks numerically and the key changes numerically on different colored index cards. Index cards shall be typewritten and inserted in a durable binder. Attach the keys to the two sets of numbered tags supplied with the cabinet. (The permanent tag and the loan key tag). Instruct the owner in proper use of the system. Install cabinet as directed by the Resident Engineer.

2.10 ARMOR PLATES, COMBINATION KICK-MOP PLATES AND DOOR EDGING

A. Conform to ANSI Standard A156.6.

B. Provide protective plates as specified below:

1. Kick-mop plates and armor plates plastic or metal, Type J100 series, color as required. When wood grain plastic plates are specified in Section 09 06 00, SCHEDULE FOR FINISHES, grain plates shall run in same direction as grain of face veneer of wood doors.
2. Provide kick-mop plates for both sides of new door, except where noted as not required. Kick-mop plates shall be 200 mm (8 inches) high. On push side of doors where jamb stop extends to floor, make combination kick-mop plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other combination kick-mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
3. Kick-mop plates are not required on following door sides:
   a) Armor plate side of doors;
   b) Exterior side of exterior doors;
   c) Closet side of closet doors;
   d) Storage side of doors to or from storage spaces; and
   e) Both sides of aluminum entrance doors.

2.11 EXIT DEVICES

A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of

building. Trim shall have lever handles similar to locksets, unless otherwise specified.

B. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

2.12 MISCELLANEOUS HARDWARE

A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types): Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E76213, conforming to ANSI A156.5. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.

B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, except as otherwise specified. Provide cylinders to operate locking devices where specified for following partitions and doors:

1. Fire-rated access doors-Engineer's key set.

C. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011, of white or light gray color, on each steel door frame, except lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.13 FINISHES

A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.

B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.

C. Miscellaneous Finishes:

1. Locks and Latchsets: 630
2. Hinges --interior doors: 630.
4. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
7. Other primed steel hardware: 652.

D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces except where otherwise specified.

E. Color of Plastic Items: See Section 09 06 00, SCHEDULE FOR FINISHES. Where colors other than chocolate brown or black are specified, color of core material may be different than color of face.

2.14 BASE METALS

Apply specified U.S. Standard finishes on different base metals as following:

Finish	**Base Metal**
652	Steel
626	Brass or bronze
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to Resident Engineer for approval.

3.2 INSTALLATION

A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted regular arm. Where closers are mounted on doors they shall be mounted with sex nuts and bolts; foot shall be fastened to frame with machine screws.

B. Substitute parallel arm or top jamb mounting for regular arm mounting where the following conditions occur:

1. Where door swing, in full open position, would be limited to less than 90 degrees due to partition construction and closer location.
2. Where door to room opens outward into corridor.

C. Hinge Size Requirements:

Door Thickness	**Door Width**	**Hinge Height**
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch) (hollow core wood doors)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

D. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim.

E. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges.

F. Hinges Required Per Door:

Doors 1500 mm (5 ft) or less in height	2 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts
Dutch type doors	4 butts
Doors with spring hinges 1370 mm (4 feet 6 inches) high or less	2 butts
Doors with spring hinges over 1370 mm (4 feet 6 inches)	3 butts

G. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

H. After locks have been installed; show in presence of Resident Engineer that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the Resident Engineer for his records.) Installation of locks which do not meet specified

keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

3.3 HARDWARE SETS

Following sets of hardware correspond to hardware symbols shown on drawings. Where hardware set for a single door is specified for a pair of doors; equip each leaf of such pair of doors with set noted. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.

HARDWARE SETS	
HW 6 Butts as required Passage latchset Combination closer holder C00241 Kick plate	HW 18 Butts as required Lock F02 or F76 Provide emergency key Kick Plate
HW 23 Butts as required Lock F04 or F81 Kick plate	HW 42 Butts as required Lock F87 or 161 W-4 Closer C02011 Holder C22511 Kick plates
HW 43 Butts as required Lock F07 or F86 Closer C02011 Kick plates	HW 52 Butts as required Lock F04 or F81 Closer C02051 Kick plates

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SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies glass, plastic, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

1.2 RELATED WORK

A. Factory glazed by manufacturer in following units:

1. Doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, and Section 08 14 00, WOOD DOORS.
2. Mirrors: Section 10 28 00, TOILET ACCESSORIES.

1.3 LABELS

A. Temporary labels:

1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
3. Temporary labels shall remain intact until glass is approved by Resident Engineer.

B. Permanent labels:

1. Locate in corner for each pane.
2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.
   a. Tempered glass.
   b. Laminated glass or have certificate for panes without permanent label.
   c. Organic coated glass.

1.4 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Certificates:

1. Certificates stating that wire glass, meets requirements for safety glazing material as specified in ANSI Z97.1.

C. Warranty: Submit written guaranty, conforming to General Condition requirements, and to "Warranty of Construction" Article in this Section.

D. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Putty, for wood sash glazing.
3. Glazing cushion.
4. Sealing compound.

E. Samples:

1. Size: 150 mm by 150 mm (6 inches by 6 inches).

F. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.

B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.

C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

1.6 PROJECT CONDITIONS

Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

1.7 WARRANTY

A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21.

1.8 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American National Standards Institute (ANSI):

Z97.1-04.....Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test.

C. American Society for Testing and Materials (ASTM):

C1363-05.....Thermal Performance of Building Assemblies, by Means of A Hot Box Apparatus

C542-05.....Lock-Strip Gaskets.

C716-06.....Installing Lock-Strip Gaskets and Infill Glazing Materials.

C864-05.....Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

C920-05.....Elastomeric Joint Sealants.

C1036-06.....Flat Glass.

C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

C1172-03.....Laminated Architectural Flat Glass.

C1349-04.....Architectural Flat Glass Clad Polycarbonate.

D635-06.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position.

D4802-07.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet.

E84-01.....Surface Burning Characteristics of Building Materials.

E330-02.....Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

E774-97.....Sealed Insulating Glass Units

D. Commercial Item Description (CID):

A-A-59502.....Plastic Sheet, Polycarbonate

E. Code of Federal Regulations (CFR):

16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 1977, with 1984 Revision.

F. National Fire Protection Association (NFPA):

80-06.....Fire Doors and Windows.

G. National Fenestration Rating Council (NFRC):

Certified Products Directory (Latest Edition).

H. Safety Glazing Certification Council (SGCC):
Certified Products Directory (Issued Semi-Annually).

I. Underwriters Laboratories, Inc. (UL):
752-05.....Bullet-Resisting Equipment.

J. Unified Facilities Criteria (UFC):
4-010-01-2007.....DOD Minimum Antiterrorism Standards for Buildings

PART 2 - PRODUCT

2.1 GLASS

A. Use thickness stated unless specified otherwise in assemblies.

B. Clear Glass:
1. ASTM C1036, Type I, Class 1, Quality q3.
2. Thickness, 6 mm (1/4 inch).

2.2 FIRE RESISTANT GLASS WITHOUT WIRE MESH

A. Fire resistant glass or glass assembly classified by UL in Building Materials Directory or other approved testing laboratory bearing permanent mark of classification.

B. Firelite.
1. UL listing R13377-1, 4.8 mm (3/16 inch) thick, unpolished.
2. Distributed by Technical Glass Products; Kirkland, WA 98033.

2.3 GLAZING ACCESSORIES

A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer’s approved shop drawings.

B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

3.2 PREPARATION

A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.

B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.

C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.

D. Verify that components used are compatible.

E. Clean and dry glazing surfaces.

F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION - GENERAL

A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.

B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.

C. Set glazing without bending, twisting, or forcing of units.

D. Do not allow glass to rest on or contact any framing member.

E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.

F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.

G. Fire Resistant Glass:

1. Wire glass: Glaze in accordance with NFPA 80.
2. Other fire resistant glass: Glaze in accordance with UL design requirements.

3.4 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.

C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.

E. Fill gaps between pane and applied stop with sealant type as recommended by glazing manufacturer to depth equal to bite on glazing, to uniform and level line.

F. Trim protruding tape edge.

3.5 REPLACEMENT AND CLEANING

A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by Resident Engineer.

B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.

C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

3.6 PROTECTION

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

3.7 GLAZING SCHEDULE

A. Fire Resistant Glass:

1. Use Fire Resistant Glass without wire mesh.

B. Tempered Glass:

1. Install in full and half glazed doors unless indicated otherwise.
2. Use clear tempered glass on interior side lights and doors, and on exterior doors and sidelights unless otherwise indicated or specified.

C. Clear Glass:

1. Interior observation windows not specified otherwise.
2. Interior pane of dual glazed windows not receiving tempered, laminated or organic coated glass, or other special glass indicated or specified.

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SECTION 09 06 00
SCHEDULE FOR FINISHES

PART I - GENERAL

1.1 DESCRIPTION

This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

1.2 MANUFACTURERS

Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

1.3 SUBMITALS

Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES—provide quadruplicate samples for color approval of materials and finishes specified in this section.

DESIGNER NOTE: See instructions.

1. COLOR SLIDES-INTERIOR VIEWS:

Room Number and Name	Item/View to be Photographed
1.	North, east, south, and west
2.	North, east, south, and west
3.	North, east, south, and west
4.	North, east, south, and west

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. MASTER PAINTING INSTITUTE: (MPI)

2001.....Architectural Painting Specification Manual

PART 2- PRODUCTS

2.1 COLOR SLIDES

A. Size 24 x 35 mm.

B. Labeled for:

1. Building name and Number.
2. Room Name and Number.

2.2 DIVISION 08 - OPENINGS

A. SECTION 08 11 13, HOLLOW METAL DOORS AND FRAMES

Paint both sides of door and frames same color including ferrous metal louvers, and hardware attached to door	
Component	Color of Paint Type and Gloss
Door	P3, Level 5
Frame	P2, Level 5

B. SECTION 08 14 00, WOOD DOORS

Component	Finish/Color
Doors	CC1, S1
Frames	P2, Level 5

C. SECTION 08 31 13, ACCESS DOORS AND FRAMES

Material	Finish/Color
Steel	P (to match adjacent surface)
Stainless steel	Satin

T. WINDOW STOOLS

Room No. and Name	Material	Finish
1160 PA Office 1158 DI/Storage 1152 AP Lab 1150 Supervisor 1149 Microscopy	Wood	P (to match adjacent surface)

U. SECTION 08 71 00, BUILDERS HARDWARE

Item	Material	Finish
Hinges		US26D
Door Closers		US26D
Closer/ Holder		US26D
Lock/ Latches		US26D
Armor Plates	Metal	Satin
Kick Mop Plates	Metal	US26D
Exit Device		US26D

2.3 DIVISION 09 - FINISHES

A. SECTION 09 30 13, CERAMIC TILING

1. CERAMIC MOSAIC TILE (FT)

Color	Size	Shape	Pattern	Manufacturer	Mfg. Color Name/No.
?	6x6	square			

2. SECTION 09 30 13, CERAMIC TILING

Finish code	Manufacturer	Mfg. Color Name/No

B. SECTION 09 51 00, ACOUSTICAL CEILINGS

Finish Code	Component	Color Pattern	Manufacturer	Mfg Name/No.
1AT	Square Lay-in 2x4 Tile	White	Armstrong	Optima Open Plan Square Lay-in, Fine Texture
1AT	Exposed Suspension System	White	Armstrong	Prelude

C. SECTION 09 65 19, RESILIENT TILE FLOORING

Finish Code	Size	Material/Component	Manufacturer	Mfg Name/No.
1VCT	12X12	VCT	Mannington	Soldpoint Visual tile, #337 Toasted Sesame

D. SECTION 09 65 16, VINYL SHEET FLOORING, HEAT WELDED SEAMS (WSF)

Finish Code	Pattern name	Manufacturer	Mfg. Color Name/No.
1WSF		Forbo	#6300 Mist

1. SECTION 09 65 16, WELDING RODS (WSF)

Finish code	Manufacturer	Mfg. Color Name/No.
1WSF	Forbo	#6300 Mist

2. SECTION 09 65 16, CAP STRIPS (WSF)

Finish Code	Manufacturer	Mfg. Color Name/No.
1WSF	Forbo	#6300 Mist

E. SECTION 09 65 13, RESILIENT BASE STAIR TREADS AND ACCESSORIES

Finish Code	Item	Height	Manufacturer	Mfg Name/No.
1RB	Rubber Base (RB)	4”	Roppe	TS 4 Cove Base P194 Burnt Umber

F. SECTION 09 91 00, PAINT AND COATINGS

1. MPI Gloss and Sheen Standards

		Gloss @60	Sheen @85
Gloss Level 1	a traditional matte finish-flat	max 5 units, and	max 10 units
Gloss Level 2	a high side sheen flat-“a velvet-like” finish	max 10 units, and	10-35 units
Gloss Level 3	a traditional “egg-shell like” finish	10-25 units, and	10-35 units
Gloss Level 4	a “satin-like” finish	20-35 units, and	min. 35 units
Gloss Level 5	a traditional semi-gloss	35-70 units	
Gloss Level 6	a traditional gloss	70-85 units	
Gloss level 7	a high gloss	more than 85 units	

2. Paint code	Gloss	Manufacturer	Mfg. Color Name/No.
P1	Level 3	ICI	#2012,Swiss Coffee
P2	Level 4	ICI	#202 Midnite Hour
P3	Level 5	ICI	#366 Ochre Tan
3. Stain Code (S)	Gloss and Transparency	Manufacturer	Mfg. Color Name/No.
	Semi		
S1	Match Existing Wood		Match Existing Wood Door

	Door Color		Color
4. Clear coatings Code(CC)	Gloss	Manufacturer	Mfg. Color Name/No.
CC1	Match Existing Wood Door Gloss		

2.4 DIVISION 10 - SPECIALTIES

A. SECTION 10 26 00, WALL GUARDS AND CORNER GUARDS

Item	Material	Manufacturer	Mfg. Color Name/No.
Corner Guards	SS	C/S	Match existing
Wall Guards and Handrail	Acrovyn	C/S Acrovyn	Match existing
Wall Guard	Acrovyn	C/S Acrovyn	Match existing

B. SECTION 12 36 00, COUNTERTOPS AND ACCESSORIES

Type	Finish/Color
Plastic Laminate	

2.7 DIVISION 22 - PLUMBING

A. SECTION 22 40 00, PLUMBING FIXTURES AND TRIM

Item	Color
Water Closet	White
Lavatories	White

PART III EXECUTION

3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS

FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Acoustical Ceiling	AT
Ceramic Mosaic Tile	FTCT
Existing	E
Floor Tile, Mosaic	FT
Gypsum Wallboard	GWB
Material	MAT
Paint	P
Rubber Base	RB
Vinyl Composition Tile	VCT
Vinyl Sheet Flooring (Welded Seams)	WSF

3.2 FINSIH SCHEDULE SYMBOLS

Symbol Definition
** Same finish as adjoining walls
- No color required
E Existing
XX To match existing
EFTR Existing finish to remain
RM Remove

3.3 ROOM FINISH SCHEDULE

A. Match adjoining or existing similar surfaces colors, textures or patterns where disturbed or damaged by alterations or new work when not scheduled.

B. ROOM FINISH SCHEDULE

Room No. and Name		FLOOR			BASE		WALL		CEILING		REMARKS
1162 Toilet		MAT	FC		MAT	FCC	MAT	FCC	MAT	FCC	
	NEW	FT	1FT	N	FT	FT1	GWB	P1	AT	1AT	
				E	FT	FT1	GWB	P1			
				S	FT	FT1	GWB	P1			
				W	FT	FT1	GWB	P1			
				C							
1160 PA Office 1158 DI/Storage 1150 Supervisor 1149 Microscopy P01 Passage C01 Corridor	NEW	VCT	1VCT	N	RB	1RB	GWB	P1	AT	1AT	
				E	RB	1RB	GWB	P1			
				S	RB	1RB	GWB	P1			
				W	RB	1RB	GWB	P1			
				C							
1152 AP Lab	NEW	WSF	1WSF	N	WSF	1WSF	GWB	P1	AT	1AT	
				E	WSF	1WSF	GWB	P1			
				S	WSF	1WSF	GWB	P1			

				W	WSF	1WSF	GWB	P1		
				C						
1146 Mech	NEW	-	-	N	RB	1RB	GWB	P1	-	Seal concrete where existing flooring removed
				E	RB	1RB	GWB	P1		
				S	RB	1RB	GWB	P1		
				W	RB	1RB	GWB	P1		
				C						
1161 Elec 1159 Elec 1147 ADP Closet 1180 DI	EXIST	E	E	N	E	E	E	P1	-	
				E	E	E	E	P1		
				S	E	E	E	P1		
				W	E	E	E	P1		
				C						
1182 Office 1180 Office 1175 Office 1174 Office	EXIST	E	E	N	E	E	GWB	P1	EXIST	Alternate No. 1
				E	E	E	GWB	P1		
				S	E	E	GWB	P1		
				W	E	E	GWB	P1		
				C						

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SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies steel studs wall systems, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

1.2 RELATED WORK

A. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS Section 09 29 00, GYPSUM BOARD.

1.3 TERMINOLOGY

A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.

C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
   1. Studs, runners and accessories.
   2. Hanger inserts.
   3. Channels (Rolled steel).
   4. Furring channels.
   5. Screws, clips and other fasteners.

C. Shop Drawings:
   1. Typical ceiling suspension system.
   2. Typical metal stud and furring construction system including details around openings and corner details.
   3. Typical shaft wall assembly
   4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society For Testing And Materials (ASTM)

A123-02.....Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products

A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

A641-03.....Zinc-Coated (Galvanized) Carbon Steel Wire

C11-07.....Terminology Relating to Gypsum and Related Building Materials and Systems

C635-04.....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings

C636-06.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

C645-07.....Non-Structural Steel Framing Members

C754-04.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

C841-03.....Installation of Interior Lathing and Furring

C954-04.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

C1002-04.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

E580-06.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM 123.

2.2 STEEL STUDS AND RUNNERS (TRACK)

A. ASTM C645, modified for thickness specified and sizes and shown.
   1. Use ASTM A525 steel, 0.9 mm (0.0359-inch) thick bare metal (20 gauge).
   2. Runners same thickness as studs.
B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
C. Doubled studs for openings and studs for supporting concrete backer-board.
D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
E. Shaft Wall Framing:
   1. Conform to rated wall construction.
   2. C-H Studs.
   3. E Studs.
   4. J Runners.
   5. Steel Jamb-Strut.

2.3 FURRING CHANNELS

A. Rigid furring channels (hat shape): ASTM C645.
B. Resilient furring channels:
   1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
   2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
C. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

A. ASTM C754, except as otherwise specified.
B. For fire rated construction: Type and size same as used in fire rating test.
C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.

D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.

E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.

F. Tie Wire and Hanger Wire:

1. ASTM A641, soft temper, Class 1 coating.
2. Gage (diameter) as specified in ASTM C754 or ASTM C841.

G. Attachments for Wall Furring:

1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.

H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)

A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.

B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.

B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.

B. Space studs not more than 610 mm (24 inches) on center.

C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.

D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.

E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions.

F. Openings:

1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.

G. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

H. Chase Wall Partitions:

1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

I. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.

J. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall furring-Stud System:

1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:
   1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
   2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
   3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
   4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
   5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
   6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.

B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.5 INSTALLING SHAFT WALL SYSTEM

A. Conform to UL Design No. U438 for two-hour fire rating. Provide one hour fire rating Shaft wall as shown on fire safety plans.

B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 600 mm (24 inches) on center.

C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.

D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.

E. Suitably frame all openings to maintain structural support for wall:
   1. Provide necessary liner fillers and shims to conform to label frame requirements.
   2. Frame openings cut within a liner panel with E studs around perimeter.
   3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

3.6 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
   1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
   2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.

B. Existing concrete construction exposed or concrete on steel decking:
   1. Use power actuated fasteners either eye pin, threaded studs or drive pins for type of hanger attachment required.
   2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists. //

C. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
   1. Install only for ceilings to receive screw attached gypsum board.
   2. Install in accordance with ASTM C636.
      a. Install main runners spaced 1200 mm (48 inches) on center.
      b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
      c. Install wall track channel at perimeter.

D. Installing Ceiling Bracing System:
   1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
   2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.
   3. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580.

3.7 TOLERANCES

A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.

B. Plumb and align vertical members within 3 mm (1/8-inch.)

C. Level or align ceilings within 3 mm (1/8-inch.)

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SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

C. Lay in gypsum board ceiling panels: Section 09 51 00, ACOUSTICAL CEILING.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Cornerbead and edge trim.
2. Finishing materials.
3. Laminating adhesive.
4. Gypsum board, each type.

C. Shop Drawings:

1. Typical gypsum board installation, showing corner details, edge trim details and the like.
2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
3. Typical shaft wall assembly.
4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Samples:

1. Cornerbead.

2. Edge trim.
3. Control joints.

E. Test Results:
1. Fire rating test, each fire rating required for each assembly.
2. Sound rating test.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing And Materials (ASTM):

C11-08.....Terminology Relating to Gypsum and Related Building Materials and Systems
C475-02.....Joint Compound and Joint Tape for Finishing Gypsum Board
C840-08.....Application and Finishing of Gypsum Board
C919-08.....Sealants in Acoustical Applications
C954-07.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
C1047-05.....Accessories for Gypsum Wallboard and Gypsum Veneer Base
C1177-06.....Glass Mat Gypsum Substrate for Use as Sheathing
C1396-06.....Gypsum Board
E84-08.....Surface Burning Characteristics of Building Materials

C. Underwriters Laboratories Inc. (UL):

Latest Edition.....Fire Resistance Directory

D. Inchcape Testing Services (ITS):

Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.

B. Coreboard or Shaft Wall Liner Panels.

1. ASTM C1396, Type X.
2. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.

C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.

D. Gypsum cores shall contain a minimum of 95 percent post industrial recycled gypsum content. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

A. ASTM C1396, Type X, water-resistant core, 16 mm (5/8 inch) thick.

B. ASTM C1177, Type X.

2.3 ACCESSORIES

A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

2.4 FASTENERS

A. ASTM C1002 and ASTM C840, except as otherwise specified.

B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).

C. Select screws of size and type recommended by the manufacturer of the material being fastened.

D. For fire rated construction, type and size same as used in fire rating test.

E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:

1. Two sides of partitions:
   a. Fire rated partitions.
   b. Smoke partitions.
   c. Sound rated partitions.
   d. Full height partitions shown (FHP).
2. One side of partitions or furring:
   a. Inside of exterior wall furring or stud construction.
   b. Room side of room without suspended ceilings.
   c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.

B. In locations other than those specified, extend gypsum board from floor to heights as follows:
   1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
   2. At ceiling of suspended gypsum board ceilings.
   3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.

B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.

C. Use gypsum boards in maximum practical lengths to minimize number of end joints.

D. Bring gypsum board into contact, but do not force into place.

E. Ceilings:
   1. For single-ply construction, use perpendicular application.
   2. For two-ply assembles:
      a. Use perpendicular application.
      b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.

F. Walls (Except Shaft Walls):
   1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
   2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
   3. Stagger screws on abutting edges or ends.

4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
8. Control Joints ASTM C840 and as follows:
   a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
   b. Not required for wall lengths less than 9000 mm (30 feet).
   c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.

G. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

H. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
2. Install in one piece, without the limits of the longest commercially available lengths.
3. Corner Beads:

a. Install at all vertical and horizontal external corners and where shown.
b. Use screws only. Do not use crimping tool.

4. Edge Trim (casings Beads):
   a. At both sides of expansion and control joints unless shown otherwise.
   b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
   c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
   d. Where shown.

3.3 INSTALLING GYPSUM SHEATHING

A. Install in accordance with ASTM C840, except as otherwise specified or shown.
B. Use screws of sufficient length to secure sheathing to framing.
C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.
D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.
E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

3.4 CAVITY SHAFT WALL

A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.
B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating. Conform to FM WALL CONSTRUCTION 25-1/HR (Non-loadbearing) for one-hour fire rating where shown.
C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
   1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
   2. Stagger joints top and bottom in adjacent panels.
   3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

D. Gypsum Board:
   1. Two hour wall:
      a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
      b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
      c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
   2. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.
   3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.
E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

3.5 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 5 finish for al finished areas open to public view.
B. Before proceeding with installation of finishing materials, assure the following:
   1. Gypsum board is fastened and held close to framing or furring.
   2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non decorated smoke barrier, fire rated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, fire rated and sound rated construction. Sanding is not required of non decorated surfaces.

3.6 REPAIRS

A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

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SECTION 09 30 13
CERAMIC TILING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies ceramic tile, waterproofing membranes for thin-set applications.

1.2 RELATED WORK

A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.

B. Color, texture and pattern of field tile and trim shapes, size of field tile, trim shapes, and color of grout specified: Section 09 06 00, SCHEDULE FOR FINISHES.

D. Metal and resilient edge strips at joints with new resilient flooring: Section 09 65 19, RESILIENT TILE FLOORING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

1. Base tile, each type, each color, each size.
2. Mosaic floor tile panels, 225 mm by 225 mm (9 inches by 9 inches), each type, color, size and pattern.
3. Wall (or wainscot) tile, each color, size and pattern.
4. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.

C. Product Data:

1. Ceramic tile, marked to show each type, size, and shape required.
2. Cementitious backer unit.
3. Dry-set Portland cement mortar and grout.
4. Divider strip.
5. Elastomeric membrane and bond coat.
6. Reinforcing tape.
7. Leveling compound.
8. Waterproofing isolation membrane.

D. Certification:

1. Master grade, ANSI A137.1.
2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
   a. Cementitious backer unit.
   b. Dry-set Portland cement mortar and grout.

c. Elastomeric membrane and bond coat.

d. Reinforcing tape.

f. Leveling compound.

f. Waterproof isolation membrane.

g. Factory mounted tile suitability for application in wet area specified under 2.1, A, 3 with list of successful in-service performance locations.

1.4 DELIVERY AND STORAGE

A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.

B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. American National Standards Institute (ANSI):

A10.20-05.....Safety Requirements for Ceramic Tile, Terrazzo, and Marble Works

A108.1A-05.....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar

A108.1B-05.....Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar

A108.1C-05.....Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar

A108.4-05.....Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesives

A108.5-05.....Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar

A108.6-05.....Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy

A108.8-05.....Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout

A108.10-05.....Installation of Grout in Tilework
A108.11-05.....Interior Installation of Cementitious Backer Units
A108.13-05.....Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone
A118.1-05.....Dry-Set Portland Cement Mortar
A118.3-05.....Chemical Resistant, Water Cleanable Tile-Setting Epoxy and Water Cleanable Tile-Setting and Grouting Epoxy Adhesive
A118.4-05.....Latex-Portland Cement Mortar
A118.5-05.....Chemical Resistant Furan Mortars and Grouts for Tile Installation
A118.6-05.....Standard Cement Grouts for Tile Installation
A118.9-05.....Cementitious Backer Units
A118.10-05.....Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation
A136.1-05.....Organic Adhesives for Installation of Ceramic Tile
A137.1-88.....Ceramic Tile

C. American Society For Testing And Materials (ASTM):
A185-07.....Steel Welded Wire Fabric, Plain, for Concrete Reinforcing
C109/C109M-07.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)
C241-90 (R2005).....Abrasion Resistance of Stone Subjected to Foot Traffic
C348-02.....Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
C627-93(R2007).....Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
C954-07.....Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness
C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Panel Products

C1027-99(R2004).....Determining "Visible Abrasion Resistance on Glazed Ceramic Tile"

C1028-07.....Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method

C1127-01.....Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface

C1178/C1178M-06.....Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel

D4397-02.....Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

D. Tile Council of America, Inc. (TCA):

2007.....Handbook for Ceramic Tile Installation

PART 2 - PRODUCTS

2.1 TILE

A. Comply with ANSI A137.1, Standard Grade, except as modified:

1. Inspection procedures listed under the Appendix of ANSI A137.1.
2. Abrasion Resistance Classification:
   a. Tested in accordance with values listed in Table 1, ASTM C 1027.
   b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms
   c. Class IV, 6000 revolutions for remaining areas.
3. Slip Resistant Tile for Floors:
   a. Coefficient of friction, when tested in accordance with ASTM C1028, required for level of performance:
      1) Not less than 0.7 (wet condition) for bathing areas.
      2) Not less than 0.8 on ramps for wet and dry conditions.
      3) Not less than 0.6, except 0.8 on ramps as stated above, for wet and dry conditions for other areas.
   b. Tile Having Abrasive Grains:
      1. Unglazed Ceramic Mosaic Tile: Abrasive grains throughout body of the tile.
4. Mosaic tile may be mounted or joined together by a resinous bonding material along tile edges.
6. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and

package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

7. Factory-Applied Temporary Protective Coating:
   a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
   b. Do not coat unexposed tile surfaces.

B. Unglazed Ceramic Mosaic Tile: Nominal 6 mm (1/4 inch) thick with cushion edges.

C. Glazed Wall Tile: Cushion edges, glazing, as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

D. Trim Shapes:
   1. Conform to applicable requirements of adjoining floor and wall tile.
   3. Use trim shapes sizes conforming to size of adjoining field wall tile unless detailed or specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
   4. Internal and External Corners:
      a. Square internal and external corner joints are not acceptable.
      b. External corners including edges: Use bullnose shapes.
      c. Internal corners: Use cove shapes.
      d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
      e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
      f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
      g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.
      h. For unglazed ceramic mosaic and glazed wall tile installed in Portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.
      i. For unglazed ceramic mosaic and glazed wall tile installed in dry-set Portland cement mortar, latex-Portland cement mortar, and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.

2.2 CEMENTITIOUS BACKER UNITS

A. Use in showers or wet areas.

B. ANSI A118.9.

C. Use Cementitious backer units in maximum available lengths.

D. Backer unit meet or exceed the following additional physical properties:

Property	Test Method	Value
Water absorption	ASTM C948	Less than 20 percent by weight

2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS

A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.

B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A118.4.

C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

2.4 FASTENERS

A. Screws for Cementitious Backer Units.

1. Standard screws for gypsum board are not acceptable.
2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
3. ASTM C954 for steel 1 mm (0.033 inch) thick.
4. ASTM C1002 for steel framing less than 0.0329 inch thick.

B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

2.5 GLASS MAT WATER RESISTANT GYPSUM BACKER BOARD

Confirm to ASTM C1178/C1178M, Optional System for Cementious Backer Units.

2.6 SETTING MATERIALS OR BOND COATS

A. Conform to TCA Handbook for Ceramic Tile Installation.

B. Portland Cement Mortar: ANSI A108.1.

C. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.

D. Elastomeric Waterproofing Membrane and Bond Coat:

1. TCA F122-02.
2. ANSI A118.10.
3. One component polyurethane, liquid applied material having the following additional physical properties:
   a. Hardness: Shore "A" between 40-60.
   b. Elongation: Between 300-600 percent.
   c. Tensile strength: Between 40-60 psig.

d. No volatile compounds.

4. Coal tar modified urethanes are not acceptable.

E. Waterproofing Isolation Membrane:

1. Sheet System TCA F122-02.
2. Optional System to elastomeric waterproof membrane.
3. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.
4. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic tile or marble to sheet. Suited for both horizontal and vertical applications.
5. Conform to the following additional physical properties:

Property	Units	Results	Test Method
Hardness Shore A	Points	70-80	ASTM D2240 (10 Second Reading)
Shrinkage	Percent	5 maximum	ASTM D1204
Brittleness		No crack remains flexible at temperature-37 degrees C (-25 degrees F)	ASTM D2497 13 mm (1/2- inch) Mandrel Bend
Retention of Properties after Heat Aging	Percent of original	80 Tensile 80 Breaking 80 Elongation	ASTM D3045, 90 degrees C (194 degrees F) for 168 hours

6. Manufacturer’s standard sheet size with prefabricated or preformed inside and outside corners.
7. Sheet manufacturer’s solvent welding liquid or xylene and edge sealant.

2.7 GROUTING MATERIALS

A. Coloring Pigments:

1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
2. Add coloring pigments to grout by the manufacturer.
3. Job colored grout is not acceptable.
4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.

B. White Portland Cement Grout:

1. ANSI A118.6.
2. Use one part white Portland cement to one part white sand passing a number 30 screen.
3. Color additive not permitted.

C. Commercial Portland Cement Grout: ANSI A118.6 color as specified.

D. Dry-Set Grout: ANSI A118.6 color as specified.

2.8 PATCHING AND LEVELING COMPOUND

A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

B. Shall have minimum following physical properties:

1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
3. Tensile strength - 600 psi per ANSI 118.7.
4. Density - 1.9.

C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 100 mm (four inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.

D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.

E. Ready for use in 48 hours after application.

2.11 WATER

Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.12 CLEANING COMPOUNDS

A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

B. Materials containing acid or caustic material not acceptable.

2.13 POLYETHYLENE SHEET

A. Polyethylene sheet conforming to ASTM D4397.

B. Nominal thickness: 0.15 mm (six mils).

C. Use sheet width to minimize joints.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three days after installation.

B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.

C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).

D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).

E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after fourth day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:

1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.

B. Variation in Plane of Wall Surfaces:

1. Not more than 1 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.
2. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

A. Patching and Leveling:

1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
   a. Thickness of compound as required to bring finish tile system to elevation shown.
   b. Float finish.
   c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

B. Walls:
   1. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
   2. Apply metal lath to framing in accordance with ANSI A108.1:
      a. Use fasteners specified in paragraph "Fasteners." Use washers when lath opening is larger than screw head.
      b. Apply scratch and leveling coats to metal lath in accordance with ANSI A108.1.C.
      c. Total thickness of scratch and leveling coats:
         1) Apply 9 mm to 16 mm (3/8 inch to 5/8 inch) thick over solid backing.
         2) 16 mm to 19 mm (5/8 to 3/4 inch) thick on metal lath over studs.
         3) Where wainscots are required to finish flush with wall surface above, adjust thickness required for flush finish.
      d. Apply scratch and leveling coats more than 19 mm (3/4 inch) thick in two coats.

C. Existing Floors and Walls:
   1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.

3.4 GLASS MAT WATER-RESISTANT GYPSUM BACKER BOARD

A. Install in accordance with manufacturer’s instructions. TCA Systems W245-01.

B. Treat joints with tape and latex-Portland cement mortar or adhesive.

3.5 CERAMIC TILE - GENERAL

A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.

B. Comply with TCA Installation Guidelines:

C. Installing Mortar Beds for Floors:
   1. Install mortar bed to not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
   2. Install floor mortar bed reinforcing centered in mortar fill.
   3. Screed finish to level plane or slope to drains where shown, float finish.

4. For thin set systems cure mortar bed not less than seven days. Do not use curing compounds or coatings.
5. For tile set with Portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.

D. Setting Beds or Bond Coats:
1. Set wall tile installed over concrete backer board in latex-Portland cement mortar, ANSI A108.1B.
2. Set trim shapes in same material specified for setting adjoining tile.

E. Workmanship:
1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
   a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
   b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
   a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
   b. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
   c. In areas where floor drains occur, slope to drains where shown.
   d. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
   a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.

b. Finish reveals of openings with tile, except where other finish materials are shown or specified.
c. At window openings, provide tile stools and reveals, except where other finish materials are shown or specified.
d. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.

10. Joints:
    a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
    b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
    c. Make joints in quarry tile work not less than 6 mm (1/4 inch) nor more than 9 mm (3/8 inch) wide. Finish joints flush with surface of tile.
    d. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.
11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
    a. Tile wall installations in wet areas, including showers, tub enclosures, laundries and swimming pools.
    b. Tile installed with chemical-resistant mortars and grouts.
    c. Tile wall installations composed of tiles 200 by 200 mm (8 by 8 inches or larger.
    d. Exterior tile wall installations.

3.6 THIN SET CERAMIC TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR

A. Installation of Tile: ANSI A108.5, except as specified otherwise.
B. Slope tile work to drains not less than 1 in 100 (1/8 inch per foot).

3.7 GROUTING

A. Grout Type and Location:
    1. Grout for glazed wall and base tile and unglazed mosaic tile latex-Portland cement grout.
B. Workmanship:
    1. Install and cure grout in accordance with the applicable standard.
    2. Portland Cement grout: ANSI A108.10.
    3. Dry-set grout: ANSI A108.5.

3.8 MOVEMENT JOINTS

A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.

B. TCA details EJ 171-02.

D. Rake out grout at joints between tile not less than 6 mm (1/4 inch) deep.

3.9 CLEANING

A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.

B. Methods and materials used shall not damage or impair appearance of tile surfaces.

C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.

D. Clean tile grouted with epoxy, furan and commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.10 PROTECTION

A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.

B. Where traffic occurs over tile floor, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.11 TESTING FINISH FLOOR

A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

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SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1- GENERAL

1.1 DESCRIPTION

A. Metal ceiling suspension system for acoustical ceilings.

B. Acoustical units.

1.2 RELATED WORK

A. Color, pattern, and location of each type of acoustical unit: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTAL

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

1. Acoustical units, each type, with label indicating conformance to specification requirements, including units specified to match existing.
2. Colored markers for units providing access.

C. Manufacturer's Literature and Data:

1. Ceiling suspension system, each type, showing complete details of installation, including suspension system specified to match existing.
2. Acoustical units, each type

D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

1.4 DEFINITIONS

A. Standard definitions as defined in ASTM C634.

B. Terminology as defined in ASTM E1264.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Society for Testing and Materials (ASTM):

A641/A641M-03.....Zinc-coated (Galvanized) Carbon Steel Wire

A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process

C423-07.....Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

C634-02 (E2007).....Standard Terminology Relating to Environmental Acoustics

C635-04.....Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

C636-06.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

E84-07.....Surface Burning Characteristics of Building Materials

E119-07.....Fire Tests of Building Construction and Materials

E413-04.....Classification for Rating Sound Insulation.

E580-06.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint

E1264-(R2005).....Classification for Acoustical Ceiling Products

PART 2- PRODUCTS

2.1 METAL SUSPENSION SYSTEM

A. ASTM C635, heavy-duty system, except as otherwise specified.
   1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
      a. Galvanized cold-rolled steel, bonderized.
      b. Extruded aluminum.
      c. Fire resistant plastic (glass fiber) having a flame spread and smoke developed rating of not more than 25 when tested in accordance with ASTM E84.
   2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
   3. Use aluminum suspension in kitchens and aluminum or fire resistant plastic in toilets adjacent to shower areas, hydrotherapy, and swimming pools.

B. Exposed grid suspension system for support of lay-in panels:
   1. Exposed grid width not less than 22 mm (7/8 inch) with not less than 8 mm (5/16 inch) panel bearing surface.
   2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
   3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.

2.2 PERIMETER SEAL

A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.

B. Thickness as required to fill voids between back of wall molding and finish wall.

C. Not less than 9 mm (3/8 inch) wide strip.

2.3 WIRE

A. ASTM A641.

B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).

C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

2.4 ANCHORS AND INSERTS

A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.

B. Hanger Inserts:

1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
2. Nailing type option for wood forms:
   a. Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
   b. Lower portion provided with not less than 8 mm (5/16 inch) hole to permit attachment of hangers.
3. Flush ceiling insert type:
   a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
   b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
   c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

C. Clips:

1. Galvanized steel.
2. Designed to clamp to steel beam or bar joists, or secure framing member together.
3. Designed to rigidly secure framing members together.
4. Designed to sustain twice the loads imposed by hangers or items supported.

2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.

B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

2.6 ACOUSTICAL UNITS

A. General:

1. ASTM E1264, weighing 3.6 kg/m^2 (3/4 psf) minimum for mineral fiber panels or tile.
2. Class A Flame Spread: ASTM 84
3. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
4. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
5. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces, except as specified otherwise in Section 09 06 00, SCHEDULE FOR FINISHES.
6. Lay-in panels: Sizes as shown, with square edges.

B. Type III Units - Mineral base with water-based painted finish less than 10 g/l VOC, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Mineral base to contain minimum 65 percent recycled content.

C. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Apply over the paint coat on the face of the unit a poly (vinyl) chloride overspray having a flame spread index of 25 or less when tested in accordance with ASTM E84.

2.7 ACCESS IDENTIFICATION

A. Markers:

1. Use colored markers with pressure sensitive adhesive on one side.
2. Make colored markers of paper of plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.

B. Use markers of the same diameter throughout building.

C. Color Code: Use following color markers for service identification:

Color.....Service

Red.....Sprinkler System: Valves and Controls

Green.....Domestic Water: Valves and Controls

Yellow.....Chilled Water and Heating Water

Orange.....Ductwork: Fire Dampers

Blue.....Ductwork: Dampers and Controls

Black.....Gas: Laboratory, Medical, Air and Vacuum

PART 3 EXECUTION

3.1 CEILING TREATMENT

A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.

B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.

C. Moldings:

1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

D. Perimeter Seal:

1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

E. Existing ceiling:

1. Where extension of existing ceilings occur, match existing.
2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

3.2 CEILING SUSPENSION SYSTEM INSTALLATION

A. General:

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m^2 (16 sf) of ceiling per hanger.

4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Anchorage to Structure:

1. Concrete:
   a. Install hanger inserts and wire loops required for support of hanger and bracing wire in concrete forms before concrete is placed. Install hanger wires with looped ends through steel deck if steel deck does not have attachment device.
   b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.
2. Steel:
   a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
      (1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
      (2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
   b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
   c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

C. Direct Hung Suspension System:

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structure overhead.
3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

D. Indirect Hung Suspension System:
1. As illustrated in ASTM C635.
2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) or center so as to insure that specified requirements are not exceeded.
3. Support main runners by specially designed clips attached to carrying channels.

E. Seismic Ceiling Bracing System:
1. Construct system is accordance with ASTM E580.
2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

3.3 ACOUSTICAL UNIT INSTALLATION

A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.

B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
1. Install tile to lay level and in full contact with exposed grid.
2. Replace cracked, broken, stained, dirty, or tile not cut for minimum

C. Markers:
1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
2. Attach colored markers to exposed grid on opposite sides of the units providing access.
3. Attach marker on exposed ceiling surface of upward access acoustical unit.

3.4 CLEAN-UP AND COMPLETION

A. Replace damaged, discolored, dirty, cracked and broken acoustical units.

B. Leave finished work free from defects.

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SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the installation of vinyl or rubber base.

1.2 RELATED WORK

A. Color and texture: Section 09 06 00, SCHEDULE FOR FINISHESS.

B. Integral base with sheet flooring: Section 09 65 16, RESILIENT SHEET FLOORING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Base and stair material manufacturer's recommendations for adhesives.
3. Application and installation instructions.

C. Samples:

1. Base: 150 mm (6 inches) long, each type and color.
2. Resilient Stair Treads: 150 mm (6 inches) long.
3. Sheet Rubber Flooring: 300 mm (12 inches) square.
4. Adhesive: Literature indicating each type.

1.4 DELIVERY

A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.

B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

A. Store materials in weather tight and dry storage facility.

B. Protect material from damage by handling and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

F1344-04.....Rubber Floor Tile

F1859-04.....Rubber Sheet Floor Covering without Backing

F1860-04.....Rubber Sheet Floor Covering with Backing

F1861-02.....Resilient Wall Base

PART 2 - PRODUCTS

2.1 GENERAL

Use only products by the same manufacturer and from the same production run.

2.2 RESILIENT BASE

A. ASTM F1861, 3 mm (1/8 inch) thick, 100 mm (4 inches) high, Type TP Rubber, Thermoplastics, Group 2-layered with molded top. Style B-cove.

B. Where carpet occurs, use Style A-straight.

C. Use only one type of base throughout.

2.3 PRIMER (FOR CONCRETE FLOORS)

As recommended by the adhesive and tile manufacturer.

2.4 LEVELING COMPOUND (FOR CONCRETE FLOORS)

Provide products with latex or polyvinyl acetate resins in the mix.

2.5 ADHESIVES

A. Use products recommended by the material manufacturer for the conditions of use.

B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.

B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.

C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

3.2 INSTALLATION REQUIREMENTS

A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the Resident Engineer.

B. Submit proposed installation deviation from this specification to the Resident Engineer indicating the differences in the method of installation.

C. The Resident Engineer reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

3.3 PREPARATION

A. Examine surfaces on which material is to be installed.

B. Fill cracks, pits, and dents with leveling compound.

C. Level to 3 mm (1/8 inch) maximum variations.

D. Do not use adhesive for leveling or filling.

E. Grind, sand, or cut away protrusions; grind high spots.

F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.

G. Substrate area dry and cured. Perform manufacturer’s recommended bond and moisture test.

H. Preparation of existing installation:

1. Remove existing base and stair treads including adhesive.
2. Do not use solvents to remove adhesives.
3. Prepare substrate as specified.

3.4 BASE INSTALLATION

A. Location:

1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, laboratory, pharmacy furniture island cabinets and where other equipment occurs.
2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.

B. Application:

1. Apply adhesive uniformly with no bare spots.
2. Set base with joints aligned and butted to touch for entire height.
3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
   a. Short pieces to save material will not be permitted.
   b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.

C. Form corners and end stops as follows:

1. Score back of outside corner.
2. Score face of inside corner and notch cove.

D. Roll base for complete adhesion.

3.5 CLEANING AND PROTECTION

A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.

B. Keep traffic off resilient material for at least 72 hours after installation.

C. Clean and polish materials in the following order:
   1. After two weeks, scrub resilient base, sheet rubber and treads materials with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.
   2. Do not polish tread and sheet rubber materials.
D. When construction traffic is anticipated, cover tread materials with reinforced kraft paper and plywood or hardboard properly secured and maintained until removal is directed by the Resident Engineer.
E. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

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SECTION 09 65 16
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the installation of sheet flooring with backing and integral cove base.

B. Grades of resilient sheet vinyl floor covering without backing having vinyl plastic wearlayer with backing.

C. Installation of sheet flooring including following:

1. Heat welded seams.
2. Integral cove base: Installed at intersection of floor and vertical surfaces.

1.2 RELATED WORK

A. Color, pattern and texture: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Resilient base required over metal base of casework: Section 12 31 00, MANUFACTURED METAL CASEWORK.

C. Resilient base over base of lockers, equipment and casework: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

D. Unbacked vinyl (homogenous) sheet flooring with welded seams: Section 09 65 16, RESILIENT SHEET FLOORING.

1.3 QUALITY CONTROL-QUALIFICATIONS:

A. The Contracting Officer shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:

1. Heat welded seaming is manufacturer's prescribed method of installation.
2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
3. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project for three years. Submit list of installations.

B. The sheet vinyl floor coverings shall meet fire performance characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.

2. Smoke Density: Less than 450 per ASTM E662.

C. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

1.4 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, submit following:

B. Manufacturer's Literature and Data:

1. Description of resilient material and accessories to be provided.
2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
3. Application and installation instructions.

C. Samples:

1. Sheet material, 38 mm by 300 mm (1-1/2 inch by 12 inch), of each color and pattern with a welded seam using proposed welding rod // 300 mm (12 inches) square for each type, pattern and color//.
2. Cap strip and fillet strip, 300 mm (12 inches) for integral base.
3. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints. Indicate orientation of directional patterns.
4. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
5. Edge strips: 150 mm (6 inches) long each type.
6. Adhesive, underlayment and primer: Pint container, each type.

1.5 PROJECT CONDITIONS

A. Maintain temperature of floor materials and room, where work occurs, above 18 ° C (65 °F) and below 38 °C (100 °F) for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 13 °C (55 °F).

B. Construction in or near areas to receive flooring work shall be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.

C. Building shall be permanently enclosed. Schedule construction so that floor receives no construction traffic when completed.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.

B. Deliver sheet flooring full width roll, completely enclosed in factory wrap, clearly marked with the manufacturer's number, type and color, production run number and manufacture date.

C. Store materials in weathertight and dry storage facility. Protect from damage due to handling, weather, and construction operations before, during and after installation. Store sheet flooring on end with ambient temperatures maintained as recommended by manufacturer.

D. Store sheet flooring on end.

E. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society For Testing Materials (ASTM):

E648-06.....Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source.

E662-06.....Specific Optical Density of Smoke Generated by Solid Materials.

E1907-06.....Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings

F710-05.....Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.

F1303-04.....Sheet Vinyl Floor Covering with Backing.

F1913-04.....Sheet Vinyl Flooring without Backing

C. Resilient Floor Covering Institute (RFCI):

Recommended Work Practices for Removal of Resilient Floor Coverings.

1.8 SCHEDULING

Interior finish work such as plastering, drywall finishing, concrete, terrazzo, ceiling work, and painting work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed. Heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.9 WARRANTY:

Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include two (2) years.

PART 2 - PRODUCTS

2.1 SHEET VINYL FLOOR COVERINGS

A. Sheet Vinyl Floor Coverings: Smooth face, minimum thickness nominal 2 mm (0.08 inch). Sheet flooring shall conform to ASTM F1913 and material requirements specified in ASTM F1303, Type II, Grade 1, backing classification not applicable. Foam backed sheet flooring is not acceptable.

B. Size: Provide maximum size sheet vinyl material produced by manufacturer to provide minimum number of joints. Minimum size width acceptable - 1200 mm (48 inches).

C. Each color and pattern of sheet flooring shall be of same production run.

2.2 WELDING ROD:

Product of floor covering manufacturer in color shall match field color of sheet vinyl covering.

2.3 APPLICATION MATERIALS AND ACCESSORIES

A. Floor and Base Adhesive: Type recommended by sheet flooring material manufacturer for conditions of use.

B. Mastic Underlayment (for concrete floors): Provide products with latex or polyvinyl acetate resins in mix. Condition to be corrected shall determine type of underlayment selected for use.

C. Base Accessories:

1. Fillet Strip: 19 mm (3/4 inch) radius fillet strip compatible with resilient sheet material.
2. Cap Strip: Extruded flanged zero edge vinyl reducer strip approximately 25 mm (one inch) exposed height with 13 mm (1/2 inch) flange.

2.4 ADHESIVES

Water resistant type recommended by the sheet flooring manufacturer for the conditions of use.

2.5 BASE CAP STRIP AND COVE STRIP

A. Extruded vinyl compatible with the sheet flooring.

B. Cap strip "J" shape with feathered edge flange approximately 25 mm (one inch) wide; top designed to receive sheet flooring with 13 mm (1/2 inch) flange lapping top of flooring

C. Cove strip 70 mm (2-3/4 inch) radius.

2.6 LEVELING COMPOUND (FOR CONCRETE FLOORS)

Provide cementitious products with latex or polyvinyl acetate resins in the mix.

2.7 PRIMER (FOR CONCRETE SUBFLOORS)

As recommended by the adhesive or sheet flooring manufacturer.

2.8 EDGE STRIPS

A. Extruded aluminum, mill finish, mechanically cleaned.

B. 28 mm (1-l/8 inch) wide, 6 mm (1/4 inch) thick, bevel one edge to 3 mm (1/8 inch) thick.

C. Drill and counter sink edge strips for flat head screws. Space holes near ends and approximately 225 mm (9 inches) on center in between.

2.9 SEALANT

A. As specified in Section 07 92 00, JOINT SEALANTS.

B. Compatible with sheet flooring.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Maintain temperature of sheet flooring above 36 °C (65 °F), for 48 hours before installation.

B. Maintain temperature of rooms where sheet flooring work occurs above 36 °C (65 °F), for 48 hours, before installation and during installation.

C. After installation, maintain temperature at or above 36 °C (65 °F.)

D. Building is permanently enclosed.

E. Wet construction in or near areas to receive sheet flooring is complete, dry and cured.

3.2 SUBFLOOR PREPARATION

A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.

1. Installer shall examine surfaces on which resilient sheet flooring is to be installed, and shall advise Contractor, in writing, of areas which are unacceptable for installation of flooring material. Installer shall advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation shall not proceed until unsatisfactory conditions have been corrected.

2. Slab substrates dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.

B. Broom or vacuum clean substrates to be covered by sheet vinyl floor coverings immediately before installation. Following cleaning, examine

substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.

C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer's directions.

D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.

E. Fill cracks, joints, depressions, and other irregularities in concrete with leveling compound.
   1. Do not use adhesive for filling or leveling purposes.
   2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
   3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.

F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.

G. Concrete Subfloor Testing:
   Determine adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MPR.

H. Preparation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives. Coordinate with Asbestos Abatement Section if asbestos abatement procedures will be involved.

I. Remove existing resilient flooring and adhesive completely in accordance with Resilient Floor Covering Institute recommendations in manual RFCI-WP. Solvents shall not be used.

3.3 INSTALLATION OF FLOORING

A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.

B. Maintain uniformity of sheet vinyl floor covering direction and avoid cross seams.

C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 150 mm (6 inches) away from parallel joints in flooring substrates.

D. Match edges of resilient floor coverings for color shading and pattern at seams.

E. Where resilient sheet flooring abuts other flooring material floors shall finish level.

F. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.

G. Inform the Resident Engineer of conflicts between this section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.

H. Install sheet in full coverage adhesives.
   1. Air pockets or loose edges will not be accepted.
   2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.

I. Keep joints to a minimum; avoid small filler pieces or strips.

J. Follow manufacturer’s recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.

K. Follow manufacturer’s recommendations regarding pattern match, if applicable.

L. Installation of Edge Strips:
   1. Locate edge strips under center lines of doors unless otherwise indicated.
   2. Set aluminum strips in adhesive, anchor with lead anchors and stainless steel Phillips screws.

M. Integral Cove Base Installation:
   1. Set preformed fillet strip to receive base.
   2. Install the base with adhesive, terminate expose edge with the cap strip.
   3. Form internal and external corners to the geometric shape generated by the cove at either straight or radius corners.
   4. Solvent weld joints as specified for the flooring. Seal cap strip to wall with an adhesive type sealant.
   5. Unless otherwise specified or shown where sheet flooring is scheduled, provide integral base at intersection of floor and vertical surfaces. Provide sheet flooring and base scheduled for room on floors and walls under and behind areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

3.4 INSTALLATION OF INTEGRAL COVED BASE

A. Set preformed cove to receive base. Install base material with adhesive and terminate exposed edge with cap strip. Integral base shall be // 100 mm (4 inches) // 150 mm (6 inches) // high.

B. Internal and external corners shall be formed to geometric shape generated by cove at either square or radius corners.

3.5 WELDING

A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.
B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.
C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.
D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

3.6 CLEANING

A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, excessive adhesive smearing will not be accepted.
B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
C. Clean and polish materials per flooring manufacturer’s written recommendations.
D. Vacuum floor thoroughly.
E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer’s recommendations.
F. Upon completion, Resident Engineer shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
G. Perform initial maintenance according to flooring manufacturer’s written recommendations.

3.7 PROTECTION:

A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.
B. Keep traffic off sheet flooring for 24 hours after installation.
C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the Resident Engineer.
D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor.

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SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the installation of solid vinyl tile flooring, vinyl composition tile flooring, and accessories.

1.2 RELATED WORK

A. Color and pattern and location in room finish schedule: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Resilient material manufacturers recommendations for adhesives, underlayment, primers and polish.
   3. Application and installation instructions.

C. Samples:
   1. Tile: 300 mm by 300 mm (12 inches by 12 inches) for each type, pattern and color.
   2. Edge Strips: 150 mm (6 inches) long, each type.
   3. Feature Strips: 150 mm (6 inches) long.

D. Shop Drawings:
   1. Layout of patterns shown on the drawings and in Section 09 06 00, SCHEDULE FOR FINISHES.
   2. Edge strip locations showing types and detail cross sections.

E. Test Reports:
   1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory.
   2. Tested per ASTM F510.

1.4 DELIVERY

A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.

B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

A. Store materials in weathertight and dry storage facility.

B. Protect from damage from handling, water, and temperature.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

D4078-02.....Water Emulsion Floor Finish

E648-08.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source

E662-06.....Specific Optical Density of Smoke Generated by Solid Materials

E1155-96 (R2008).....Determining Floor Flatness and Floor Levelness Numbers

F510-93 (R 2004).....Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method

F710-08.....Preparing Concrete Floors to Receive Resilient Flooring

F1066-04.....Vinyl Composition Floor Tile

F1344-04.....Rubber Floor Tile

F1700-04.....Solid Vinyl Floor Tile

C. Resilient Floor Covering Institute (RFCI):

IP #2.....Installation Practice for Vinyl Composition Tile (VCT)

D. Federal Specifications (Fed. Spec.):

SS-T-312.....Tile Floor: Asphalt, Rubber, Vinyl and Vinyl Composition

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish product type, materials of the same production run and meeting following criteria.

B. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.

C. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E 648.

D. Smoke density: Less than 450 per ASTM E662.

2.2 VINYL COMPOSITION TILE

A. ASTM F1066, Composition 1, Class I (solid color) Class 2 (through pattern), 300 mm (12 inches) square, 3 mm (1/8 inch) thick.

B. Color and pattern uniformly distributed throughout thickness.

2.3 SOLID VINYL-TILE

A. ASTM F1700, 300 mm (12 by 12 inches) square, 3 mm (1/8 inch) thick, homogenous throughout.

B. Color and Pattern uniformly distributed throughout thickness.

C. Where solid vinyl tiles are specified, seek products with recycled content.

2.4 ADHESIVES

A. Comply with applicable regulations regarding toxic and hazardous materials Green Seal (GS-36) for commercial adhesive.

B. Use low-VOC adhesive during installation. Water based is preferred over solvent based adhesives.

2.5 PRIMER (FOR CONCRETE SUBFLOORS)

As recommended by the adhesive and tile manufacturer.

2.6 LEVELING COMPOUND (FOR CONCRETE FLOORS)

A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

B. Determine the type of underlayment selected for use by the condition to be corrected.

2.7 POLISH AND CLEANERS

A. Cleaners RFCI CL-1.

B. Polish: ASTM D4078.

2.8 EDGE STRIPS

A. 28 mm (1-1/8 inch) wide unless shown otherwise.

B. Bevel from maximum thickness to minimum thickness for flush joint unless shown otherwise.

C. Extruded aluminum, mill finish, mechanically cleaned:

1. Drill and counter sink edge strip for flat head screws.
2. Space holes near ends and approximately 225 mm (9 inches) on center between.

D. Resilient Edge Strip or Reducer Strip: Fed. Specs. SS-T-312, Solid vinyl.

2.9 SCREWS

Stainless steel flat head screw.

2.10 FEATURE STRIPS

A. Use same material as floor tile.

B. Sizes and shapes as shown.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.

B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °F), for at least 48 hours, before, during and after installation.

C. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

3.2 SUBFLOOR PREPARATION

A. Verify that concrete slabs comply with ASTM F710. At existing slabs, determine levelness by F-number method in accordance with ASTM E1155. Overall value shall not exceed as follows:

FF30/FL20

B. Correct conditions which will impair proper installation.

C. Fill cracks, joints and other irregularities in concrete with leveling compound:

1. Do not use adhesive for filling or leveling purposes.
2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joints.

D. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing curing or cleaning agents.

E. Concrete Subfloor Testing:
Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.

F. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.

G. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.

H. Preparation of existing installation shall include the removal of existing resilient floor and existing adhesive. Do not use solvents to remove adhesives.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.

B. Mix tile from at least two containers. An apparent line either of shades or pattern variance will not be accepted.

C. Tile Layout:

1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.
2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.
3. Place tile pattern in the same direction; do not alternate tiles.

D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.

E. Application:

1. Apply adhesive uniformly with no bare spots.
   a. Conform to RFC1-TM-6 for joint tightness and for corner intersection unless layout pattern shows random corner intersection.
   b. More than 5 percent of the joints not touching will not be accepted.
2. Roll tile floor with a minimum 45 kg (100 pound) roller. No exceptions.
3. The Resident Engineer may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken removed tile.

F. Installation of Edge Strips:

1. Locate edge strips under center line of doors unless otherwise shown.
2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws specified.
3. Where tile edge is exposed, butt edge strip to touch along tile edge.
4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

3.4 CLEANING AND PROTECTION

A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.

B. Keep traffic off resilient material for a minimum 72 hours after installation.

C. Clean and polish materials in the following order:

1. For the first two weeks sweep and damp mopped only.
2. After two weeks, scrub resilient materials with a minimum amount of water and a mild detergent. Leave surface clean and free of detergent residue.

3. Apply polish to the floors in accordance with the polish manufacturer's instructions.

D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by Resident Engineer. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by Resident Engineer.

E. When protective materials are removed and immediately prior to acceptance, replace any damage tile, re-clean resilient materials, lightly re-apply polish and buff floors.

3.5 LOCATION

A. Unless otherwise specified or shown, install tile flooring, on floor under areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

B. Extend tile flooring for room into adjacent closets and alcoves.

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SECTION 09 91 00
PAINTING

PART 1-GENERAL

1.1 DESCRIPTION

A. Section specifies field painting.

B. Section specifies prime coats which may be applied in shop under other sections.

C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

1.2 RELATED WORK

A. Shop prime painting of steel and ferrous metals: Division 08 - OPENINGS, Division 10 - SPECIALTIES, Division 11 - EQUIPMENT, Division 12 - FUNISHINGS, Division 13 - SPECIAL CONSTRUCTION, , Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY sections.

B. Contractor option: Prefinished flush doors with transparent finishes: Section 08 14 00, WOOD DOORS.

C. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

C. Sample Panels:

1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).

3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10 inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.
4. Attach labels to panel stating the following:
   a. Federal Specification Number or manufacturers name and product number of paints used.
   b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
   c. Product type and color.
   d. Name of project.
5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

D. Sample of identity markers if used.

E. Manufacturers' Certificates indicating compliance with specified requirements:
   1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.

1.4 DELIVERY AND STORAGE

A. Deliver materials to site in manufacturer's sealed container marked to show following:
   1. Name of manufacturer.
   2. Product type.
   3. Batch number.
   4. Instructions for use.
   5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:
   1. Federal Specification Number, where applicable, and name of material.
   2. Surface upon which material is to be applied.
   3. If paint or other coating, state coat types; prime, body or finish.

C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.

D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

1.5 MOCK-UP PANEL

A. Before starting application of water paint mixtures, apply paint as specified to an area, not to exceed 9 m^2 (100 ft^2), selected by Resident Engineer.

B. Finish and texture approved by Resident Engineer will be used as a standard of quality for remainder of work.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. American Conference of Governmental Industrial Hygienists (ACGIH):
ACGIH TLV-BKLT-1992.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
ACGIH TLV-DOC.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Sixth Edition)

C. American National Standards Institute (ANSI):
A13.1-96.....Scheme for the Identification of Piping Systems

D. American Society for Testing and Materials (ASTM):
D260-86.....Boiled Linseed Oil

E. Commercial Item Description (CID):
A-A-1555.....Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)
A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)

F. Federal Specifications (Fed Spec):
TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):
No. 1-06.....Aluminum Paint (AP)
No. 4-06.....Interior/ Exterior Latex Block Filler
No. 5-06.....Exterior Alkyd Wood Primer
No. 7-06.....Exterior Oil Wood Primer
No. 8-06.....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
No. 9-06.....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)
No. 10-06.....Exterior Latex, Flat (AE)
No. 11-06.....Exterior Latex, Semi-Gloss (AE)
No. 18-06.....Organic Zinc Rich Primer
No. 22-06.....Aluminum Paint, High Heat (up to 590% - 1100F) (HR)

No. 26-06.....Cementitious Galvanized Metal Primer
No. 27-06.....Exterior / Interior Alkyd Floor Enamel, Gloss (FE)
No. 31-06.....Polyurethane, Moisture Cured, Clear Gloss (PV)
No. 36-06.....Knot Sealer
No. 43-06.....Interior Satin Latex, MPI Gloss Level 4
No. 44-06.....Interior Low Sheen Latex, MPI Gloss Level 2
No. 45-06.....Interior Primer Sealer
No. 46-06.....Interior Enamel Undercoat
No. 47-06.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
No. 48-06.....Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
No. 49-06.....Interior Alkyd, Flat, MPI Gloss Level 1 (AK)
No. 50-06.....Interior Latex Primer Sealer
No. 51-06.....Interior Alkyd, Eggshell, MPI Gloss Level 3
No. 52-06.....Interior Latex, MPI Gloss Level 3 (LE)
No. 53-06.....Interior Latex, Flat, MPI Gloss Level 1 (LE)
No. 54-06.....Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
No. 59-06.....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss (FE)
No. 60-06.....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
No. 66-06.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved) (FC)
No. 67-06.....Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR)
No. 68-06.....Interior/ Exterior Latex Porch & Floor Paint, Gloss
No. 71-06.....Polyurethane, Moisture Cured, Clear, Flat (PV)
No. 74-06.....Interior Alkyd Varnish, Semi-Gloss
No. 77-06.....Epoxy Cold Cured, Gloss (EC)
No. 79-06.....Marine Alkyd Metal Primer
No. 90-06.....Interior Wood Stain, Semi-Transparent (WS)
No. 91-06.....Wood Filler Paste
No. 94-06.....Exterior Alkyd, Semi-Gloss (EO)
No. 95-06.....Fast Drying Metal Primer
No. 98-06.....High Build Epoxy Coating
No. 101-06.....Epoxy Anti-Corrosive Metal Primer
No. 108-06.....High Build Epoxy Coating, Low Gloss (EC)
No. 114-06.....Interior Latex, Gloss (LE) and (LG)
No. 119-06.....Exterior Latex, High Gloss (acrylic) (AE)
No. 135-06.....Non-Cementitious Galvanized Primer

No. 138-06.....Interior High Performance Latex, MPI Gloss Level 2 (LF)

No. 139-06.....Interior High Performance Latex, MPI Gloss Level 3 (LL)

No. 140-06.....Interior High Performance Latex, MPI Gloss Level 4

No. 141-06.....Interior High Performance Latex (SG) MPI Gloss Level 5

H. Steel Structures Painting Council (SSPC):

SSPC SP 1-00 (R2004)....Solvent Cleaning

SSPC SP 2-00 (R2004)....Hand Tool Cleaning

SSPC SP 3-00 (R2004)....Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

A. Identity markers options:

1. Pressure sensitive vinyl markers.
2. Snap-on coil plastic markers.

B. Interior Satin Latex: MPI 43.

C. Interior Low Sheen Latex: MPI 44.

D. Interior Primer Sealer: MPI 45.

E. Interior Latex Primer Sealer: MPI 50.

F. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.

G. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.

H. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.

I. Interior Wood Stain, Semi-Transparent (WS): MPI 90.

J. Fast Drying Metal Primer: MPI 95.

K. Interior latex, Gloss (LE) and (LG): MPI 114.

L. Interior High Performance Latex, MPI Gloss Level 2(LF): MPI 138.

M. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.

N. Interior High Performance Latex, MPI Gloss Level 4: MPI 140.

O. Interior High Performance Latex (SG), MPI Gloss Level 5: MPI 141

2.2 PAINT PROPERTIES

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.

1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
2. Lead-Base Paint:
   a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
   b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
3. Asbestos: Materials shall not contain asbestos.
4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high performance acrylic paints in place of alkyd paints, where possible.
7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.

1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.

B. Atmospheric and Surface Conditions:

1. Do not apply coating when air or substrate conditions are:
   a. Less than 3 degrees C (5 degrees F) above dew point.

b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
5. Apply only on clean, dry and frost free surfaces except as follows:
   a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
   b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.

3.2 SURFACE PREPARATION

A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.

B. General:
   1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
   2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
   3. See other sections of specifications for specified surface conditions and prime coat.
   4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

C. Wood:
   1. Sand to a smooth even surface and then dust off.
   2. Sand surfaces showing raised grain smooth between each coat.
   3. Wipe surface with a tack rag prior to applying finish.
   4. Surface painted with an opaque finish:
      a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
      b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
   5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler

paste. Sand the surface to make smooth and finish flush with adjacent surface.

6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

D. Ferrous Metals:
1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
   a. This includes flat head countersunk screws used for permanent anchors.
   b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

E. Gypsum Plaster and Gypsum Board:
1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with

texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.3 PAINT PREPARATION

A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.

B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.

D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.

E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.

C. Apply each coat evenly and cover substrate completely.

D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.

E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.

F. Apply by brush or roller or spray, except as otherwise specified.

G. Do not spray paint in existing occupied spaces unless approved by Resident Engineer, except in spaces sealed from existing occupied spaces.

1. Apply painting materials specifically required by manufacturer to be applied by spraying.
2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.5 PRIME PAINTING

A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.

B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.

C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.

D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.

E. Wood and Wood Particleboard:

1. Use same kind of primer specified for exposed face surface.
   a. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
   b. Transparent finishes as specified under Transparent Finishes on Wood except Floors.
2. Apply two coats of primer sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one coat of primer sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.

F. Metals except boilers, incinerator stacks, and engine exhaust pipes:

1. Steel and iron: MPI 95 (Fast Drying Metal Primer). Use MPI 101 (Cold Curing Epoxy Primer) where finish is specified.
2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer) MPI 135 (Non-Cementitious Galvanized Primer).

G. Gypsum Board:

1. Surfaces scheduled to have MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) finish.
2. Primer: MPI 50(Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) in bathrooms.

3.6 INTERIOR FINISHES

A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
   a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise.

C. Gypsum Board:

1. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)).

F. Wood:

1. Sanding:
   a. Use 220-grit sandpaper.
   b. Sand sealers and varnish between coats.
   c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.
2. Sealers:
   a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
   b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
   c. Sand as specified.
3. Paint Finish:
   a. One coat of MPI 45 (Interior Primer Sealer) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) (SG).
4. Transparent Finishes on Wood Except Floors.
   a. Stain Finish:
      1) One coat of MPI 90 (Interior Wood Stain, Semi-Transparent (WS)).
      2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.
      3) One coat of sealer as written in 2.1 E.
      4) Two coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat (PV).

3.7 REFINISHING EXISTING PAINTED SURFACES

A. Clean, patch and repair existing surfaces as specified under surface preparation.

B. Remove and reinstall items as specified under surface preparation.

C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.

D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.

E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.

F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.

G. Sand or dull glossy surfaces prior to painting.

H. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.8 PAINT COLOR

A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.

B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.

C. Coat Colors:

1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:

1. Paint to match color of casework where casework has a paint finish.
2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.9 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.

B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified under paragraph H, colors.

C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND SECURITY.

D. Paint after tests have been completed.

E. Omit prime coat from factory prime-coated items.

F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.

G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.

H. Color:

1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:

   a. White .....Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
   b. Gray: .....Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
   c. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
   d. Federal Safety Orange: .Entire lengths of electrical conduits containing feeders 600 volts or more.

I. Apply paint systems on properly prepared and primed surface as follows:

1. Exterior Locations:

   a. Apply two coats of MPI 11 (Exterior Latex, Semi Gloss (AE)) to the following metal items:
      Galvanized and zinc-copper alloy metal.

2. Interior Locations:
   a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
      1) Metal under 94 degrees C (200 degrees F) of items such as bare piping, fittings, hangers and supports.
      2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
      3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
   d. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
3. Other exposed locations:
   a. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 11 (Exterior Latex Semi-Gloss (AE).

3.10 BUILDING AND STRUCTURAL WORK FIELD PAINTING

A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.
   1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES.
   2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
   3. Painting of ferrous metal and galvanized metal.
   4. Identity painting and safety painting.
B. Building and Structural Work not Painted:
   1. Prefinished items:
      a. Casework, doorS, metal panels, wall covering, and similar items specified factory finished under other sections.
      b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
   2. Finished surfaces:
      a. Hardware except ferrous metal.
      b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
      c. Signs, fixtures, and other similar items integrally finished.

3. Concealed surfaces:
   a. duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
   b. Inside walls or other spaces behind access doors or panels.
   c. Surfaces concealed behind permanently installed casework and equipment.
4. Moving and operating parts:
   a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
   b. Tracks for overhead or coiling doors, shutters, and grilles.
5. Labels:
   a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
   b. Identification plates, instruction plates, performance rating, and nomenclature.
6. Galvanized metal:
   a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
   b. Except where specifically specified to be painted.

3.11 IDENTITY PAINTING SCHEDULE

A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
   1. Legend may be identified using 2.1 G options or by stencil applications.
   2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12 000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
   3. Locate Legends clearly visible from operating position.
   4. Use arrow to indicate direction of flow.
   5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
      a. High Pressure - 414 kPa (60 psig) and above.
      b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).

c. Low Pressure - 103 kPa (14 psig) and below.

d. Add Fuel oil grade numbers.

6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND BBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Yellow	Black	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Yellow	Black	H.P. _____*
High Pressure Condensate Return		Yellow	Black	H.P. Ret ____*
Medium Pressure Steam		Yellow	Black	M. P. Stm ____*
Medium Pressure Condensate Return		Yellow	Black	M.P. Ret _____*
Low Pressure Steam		Yellow	Black	L.P. Stm _____*
Low Pressure Condensate Return		Yellow	Black	L.P. Ret _____*
High Temperature Water Supply		Yellow	Black	H. Temp Wtr Sup
High Temperature Water Return		Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		Green	White	Fuel Oil-Grade __*
Boiler Water Sampling		Yellow	Black	Sample
Chemical Feed		Yellow	Black	Chem Feed
Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent
Alkali		Yellow	Black	Alk

Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Yellow	Black	Acid Waste
Vent		Yellow	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler		Red	White	Auto Spr
Standpipe		Red	White	Stand
Sprinkler		Red	White	Drain

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6100 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000.
8. See Sections for methods of identification, legends, and abbreviations of the following:

d. Conduits containing high voltage feeders over 600 volts: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS / Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE PARTITION" or, "FIRE PARTITION" as applicable.
3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
4. Use semigloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:

1. Apply stenciled number and letters to correspond with grid numbering and lettering shown.
2. Paint numbers and letters 100 mm (4 inches) high, locate 450 mm (18 inches) below overhead structural slab.
3. Apply on four sides of interior columns and on inside face only of exterior wall columns.
4. Color:
   a. Use black on concrete columns.
   b. Use white or contrasting color on steel columns.

3.12 PROTECTION CLEAN UP, AND TOUCH-UP

A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.

C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies wall guards (crash rails or bumper guards), handrail/wall guard combinations, corner guards and door/door frame protectors.

1.2 RELATED WORK

A. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.

B. Color and texture of aluminum and resilient material: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Show design and installation details.

C. Manufacturer's Literature and Data:

1. Handrail/Wall Guard Combinations.
2. Wall Guards.
3. Corner Guards.

D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

1.4 DELIVERY AND STORAGE

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.

B. Protect from damage from handling and construction operations before, during and after installation.

C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B221-07.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

D256-06.....Impact Resistance of Plastics

D635-06.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

E84-07.....Surface Burning Characteristics of Building Materials

C. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual

D. National Fire Protection Association (NFPA):
80-06.....Standard for Fire Doors and Windows

E. Society of American Automotive Engineers (SAE):
J 1545-05.....Instrumental Color Difference Measurement for Exterior Finishes.

F. Underwriters Laboratories Inc. (UL):
Annual Issue.....Building Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A167, Type 302B.

B. Resilient Material:

1. Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
   a. Minimum impact resistance of 1197 ps (25 ft lbs per sq.ft) when tested in accordance with ASTM D256 (Izod impact, ft.lbs. per inch notch).
   b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
   c. Rated self extinguishing when tested in accordance with ASTM D635.
   d. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
   e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
   f. Same finish on exposed surfaces.

2.2 CORNER GUARDS

A. Resilient, Shock-Absorbing Corner Guards: Surface mounted type of 6 mm 1/4-inch corner) formed to profile shown.

1. Snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.6 mm (0.063-inch) thick extruded aluminum retainer. Provide appropriate mounting hardware, cushions and base plates as required.

2. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.

B. Stainless Steel Corner Guards: Fabricate of 1.6 mm (0.0625-inch) thick stainless steel. Form guards of dimensions and to contour shown.

2.3 WALL GUARDS AND HANDRAILS

A. Resilient Wall Guards and Handrails:

1. Handrail/Wall Guard Combination: Snap-on covers of resilient material, minimum 2 mm (0.078-inch) thick, shall be free-floated on a continuous, extruded aluminum retainer, minimum 1.8 mm (0.072-inch) thick, anchored to wall at maximum 760 mm (30 inches) on center.
2. Wall Guards (Crash Rails): Snap-on covers of resilient material, minimum 2.8 mm (0.110-inch) thick, shall be free-floated over 50 mm (two-inch) wide aluminum retainer clips, minimum 2.3 mm (0.090-inch) thick, anchored to wall at maximum 600 mm (24 inches) on center, supporting a continuous aluminum retainer, minimum 1.6 mm (0.062-inch) thick; or, shall be free-floated over a continuous extruded aluminum retainer, minimum 2.3 (0.090-inch) thick anchored to wall at maximum 600 mm (24 inches) on center.
3. Provide handrails and wall guards (crash rails) with prefabricated and closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners shall be field adjustable to assure close alignment with handrails and wall guards (crash rails). Screw or bolt closure caps to aluminum retainer.

2.4 HIGH IMPACT WALL COVERING

A. Fabricate from vinyl acrylic or polyvinyl chloride resilient material minimum 6mm (0.20 inch) thick designed specially for interior use.

B. Coordinate with door //guard rail// protection material and supplier for proper fit, installation and color.

C. Provide adhesive as recommended by the wall covering manufacturer.

2.5 FASTENERS AND ANCHORS

A. Provide fasteners and anchors as required for each specific type of installation.

B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.

2.6 FINISH

A. In accordance with NAAMM AMP 500 series.

B. Stainless Steel: NAAMM finish Number 4.

C. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

PART 3 - INSTALLATION

3.1 RESILIENT CORNER GUARDS

Install corner guards on walls in accordance with manufacturer's instructions.

3.2 STAINLESS STEEL CORNER GUARDS

Mount guards on external corners of interior walls, partitions and columns as shown.

A. Where corner guards are installed on gypsum board, clean surface and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from around edge of guard and allow to cure undisturbed for 24 hours.

3.3 HIGH IMPACT WALL COVERING

A. Surfaces to receive protection shall be clean, smooth and free of obstructions.

B. Install protectors after frames are in place but preceding installation of doors in accordance with approved shop drawings and manufacturers specific instructions.

C. Apply with adhesive in controlled environment according to manufacture’s recommendations.

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SECTION 10 28 00
TOILET ACCESSORIES

1.1 DESCRIPTION

A. This section specifies manufactured items usually used in toilets and at sinks in related spaces.

B. Items Specified:

1. Paper towel dispenser.
2. Waste receptacles.
3. Toilet tissue dispenser.
4. Grab Bars.
5. Metal framed mirror.

B. This section also specifies custom fabricated items used in toilets and related spaces.

1.2 RELATED WORK

A. Color of finishes: Section 09 06 00, SCHEDULE FOR FINISHES

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Each product specified.
2. Paper towel dispenser and combination dispenser and disposal units.
3. Metal framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
4. Grab bars, showing design and each different type of anchorage.

C. Samples:

1. One of each type of accessory specified.
2. After approval, samples may be used in the work.

D. Manufacturer's Literature and Data:

1. All accessories specified.
2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
3. Show working operations of spindle for toilet tissue dispensers.
4. Mop racks.

E. Manufacturer's Certificates:

1. Attesting that soap dispensers are fabricated of material that will not be affected by liquid soap or aseptic detergents, Phisohex and solutions containing hexachlorophene.
2. Anodized finish as specified.

1.4 QUALITY ASSURANCE

A. Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

B. Each accessory type shall be the same and be made by the same manufacturer.

C. Each accessory shall be assembled to the greatest extent possible before delivery to the site.

D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 PACKAGING AND DELIVERY

A. Pack accessories individually to protect finish.

B. Deliver accessories to the project only when installation work in rooms is ready to receive them.

C. Deliver inserts and rough-in frames to site at appropriate time for building-in.

D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

1.6 STORAGE

A. Store products in weathertight and dry storage facility.

B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A167-99(R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

A176-99(R2004).....Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip

A269-07.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A312/A312M-06.....Seamless and Welded Austenitic Stainless Steel Pipes

A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B456-03.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

C1036-06.....Flat Glass

C1048-04.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass

D635-06.....Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position

F446-85 (R2004).....Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

A269-07.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

D3453-01.....Flexible Cellular Materials - Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications

D3690-02.....Vinyl-Coated and Urethane-Coated Upholstery Fabrics

C. The National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series.....Metal Finishes Manual

AMP 500-505-88.....Metal Finishes Manual and Finishes for Stainless Steel

D. American Welding Society (AWS):

D10.4-86 (R2000).....Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing

E. Federal Specifications (Fed. Specs.):

A-A-3002.....Mirrors, Glass

FF-S-107C (2).....Screw, Tapping and Drive

FF-S-107C.....Screw, Tapping and Drive.

WW-P-541E(1).....Plumbing Fixtures (Accessories, Land Use) Detail Specification

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.

B. Stainless Steel:

1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.

C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.

D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.

E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.

F. Glass:
1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror doors in medicine cabinets.
2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.
3. ASTM C1048, Kind FT, Condition A, Type 1, Class 1 (use in Mental Health and Behavior Nursing Unit Psychiatric Patient Areas and Security Examination Rooms where mirrors and glass are specified).

G. Vinyl Covering: ASTM D3690, Vinyl coated fabric, Class A.

H. Plywood: PS1, Grade CD.

2.2 FASTENERS

A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.

B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).

C. Toggle Bolts: For use in hollow masonry or frame construction.

D. Hex bolts: For through bolting on thin panels.

E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.

F. Screws:
1. ASME B18.6.4.
2. Fed Spec. FF-S-107, Stainless steel Type A.

G. Adhesive: As recommended by manufacturer for products to be joined.

2.3 FINISH

A. In accordance with NAAMM AMP 500 series.

B. AA-M32
1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
2. Stainless Steel: NAAMM AMP 503, finish number 4.
3. Ferrous Metal:

a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.

2.4 FABRICATION - GENERAL

A. Welding, AWS D10.4.
B. Grind dress, and finish welded joints to match finish of adjacent surface.
C. Form exposed surfaces from one sheet of stock, free of joints.
D. Provide steel anchors and components required for secure installation.
E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
I. Key items alike.
J. Provide templates and rough-in measurements as required.
K. Round and deburr edges of sheets to remove sharp edges.

2.5 PAPER TOWEL DISPENSERS

A. Surface mounted type with sloping top.
B. Dispensing capacity for 300 sheets of any type of paper toweling.
C. Fabricate of stainless steel.
D. Provide door with continuous hinge at bottom, and either spring tension cam lock or tumbler lock, keyed alike, at top and a refill sight slot in front.

2.6 WASTE RECEPTACLES

A. Semi-recessed type, without doors. Fed. Spec WW-P-541, Type II.
B. Fabricate of stainless steel.
C. Form face frame from one piece.
D. Provide removable waste receptacle of approximately (12 gallon) capacity, fabricated of stainless steel.
E. Waste receptacle key locked in place.

2.7 TOILET TISSUE DISPENSERS

A. Double roll surface mounted type.
B. Mount on continuous backplate.
C. Removable spindle ABS plastic or chrome plated plastic.
D. Wood rollers are not acceptable.

2.8 GRAB BARS

A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.

B. Fabricate of either stainless steel, except use only one type throughout the project:

1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.

C. Concealed mount, except grab bars mounted at floor and swing up.

D. Bars:

1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
   a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
2. Fabricate in one continuous piece with ends turned toward walls, except swing up and where grab bars are shown continuous around three sides of showers, bars may be fabricated in two sections, with concealed slip joint between.
3. Continuous weld intermediate support to the grab bar.
4. Swing up bars manually operated. Designed to prevent bar from falling when in raised position.

E. Flange for Concealed Mounting:

1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.

F. Flange for Exposed Mounting:

1. Minimum 5 mm (3/16 inch) thick, approximately 75 mm (3 inch) diameter.
2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.
3. Where mounted on floor, provide four equally spaced holes, sized to accommodate 5 mm (3/8 inch) diameter bolts, not more than 5 mm (3/8 inch) from edge of flange.

G. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.

H. Back Plates:

1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.

2.9 METAL FRAMED MIRRORS

A. Fed. Spec. A-A-3002 metal frame; stainless steel, type 302 or 304.

B. Mirror Glass:

1. Minimum 6 mm (1/4 inch) thick.
2. Set mirror in a protective vinyl glazing tape.

C. Frames:

1. Channel or angle shaped section with face of frame not less than 9 mm (3/8 inch) wide. Fabricate with square corners.
2. Use either 0.9 mm (0.0359 inch) thick stainless steel, chrome finished steel, or extruded aluminum, with clear anodized finish 0.4 mils thick.
3. Filler:
   a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
   b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.

D. Back Plate:

1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before starting work notify Resident Engineer in writing of any conflicts detrimental to installation or operation of units.

B. Verify with the Resident Engineer the exact location of accessories.

3.2 INSTALLATION

A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry. Expansion bolt to concrete or solid masonry.

C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
D. Install accessories plumb and level and securely anchor to substrate.
E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.
G. Align mirrors, dispensers and other accessories even and level, when installed in battery.
H. Install accessories to prevent striking by other moving, items or interference with accessibility.
I. Install wall mirrors in Mental Health and Behavioral Units with tamper resistant screws that are flush mounted so that they will not support a rope or material for hanging.

3.3 SCHEDULE OF ACCESSORIES

Basis-of-Design Products: The designs for toilet and bath accessories are based on products manufactured by Bobrick Washroom Equipment, Inc., unless otherwise indicated. Subject to compliance with requirements, provide the named product or comparable product by one of the following:

1. American Specialties, Inc.
2. Bradley Corporation.

Mirror Units: Where this designation is indicated, provide mirror units complying with the following:

1. Stainless-Steel, Angle-Framed Mirror: Fabricate frame from minimum nominal 0.05-inch-(1.3-mm-) thick stainless-steel angles, with square corners mitered, welded, and ground smooth.
2. Products: Provide the following where indicated on the Drawings:

   a. Types: 24 inches wide by 36 inches high.

      1) Product: No. **B-290 2436.**

Grab Bars: Where these designations are indicated, provide stainless-steel grab bars complying with the following:

3. Stainless-Steel Nominal Thickness: Minimum 0.05 inch (1.3 mm).
4. Mounting: Concealed with manufacturer's standard flanges and anchors.
5. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
6. Outside Diameter: 1-1/2 inches (38 mm) for heavy-duty applications.
7. Products:

a. Type, 36 inches long: No. **B-6806.99 x 36.**
b. Type, 42 inches long: No. **B-6806.99 x 42.**
c. Type, 18 inches long: No. **B-6806.99 x 18.**

B. Grab Bars: Where this designation is indicated, provide swing-up stainless-steel grab bar complying with the following:

1. Swing-Up Operation: Manually raised for approach or departure and lowered to horizontal position for support; once grab bar is raised more than 45° from horizontal position, counterweighted design prevents grab bar from falling back down to full horizontal position.
2. Stainless-Steel Nominal Thickness: Minimum 0.05 inch (1.3 mm).
3. Mounting: Provide manufacturer's standard concealed anchor plate and vandal-resistant, stainless steel, flat-head machine screws.
4. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
5. Outside Diameter: 1-1/4 inches (32 mm) for medium-duty applications.
6. Products: **Model 8370-102-2;** Bradley Corporation.

3.4 CLEANING

After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

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SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

This section covers recessed fire extinguisher cabinets.

1.2 RELATED WORK

A. Acrylic glazing: Section 08 80 00, GLAZING.

B. Field Painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

1.4 APPLICATION PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Testing and Materials (ASTM):
D4802-02.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

Recessed type with flat trim of size and design shown.

2.2 FABRICATION

A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.

B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.

1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.
2. Design doors to open 180 degrees.
3. Provide continuous hinge, pull handle, and adjustable roller catch.

2.3 FINISH

A. Finish interior of cabinet body with baked-on semigloss white enamel.

B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

PART 3 - EXECUTION

A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.

B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

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SECTION 11 53 13
LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies laboratory fume hoods including auxiliary-air walk-in, waste containment, and benchtop type fume hoods.

1.2 RELATED WORK

A. Deduct Alternate No 2: Section 01 00 00, GENERAL REQUIREMENTS.

B. Plumbing Connections: Section 22 11 00, FACILITY WATER DISTRIBUTION and Section 22 13 00, FACILITY SANITARY SEWERAGE Section 22 66 00, CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.

C. Ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS.

D. Electrical Connections: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

E. Electrical Devices: Section 26 27 26, WIRING DEVICES.

F. Motor Starters: Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 PERFORMANCE REQUIREMENTS

A. Average Face Velocity: For laboratory fume hoods, 0.51 m/s (100 fpm) with sashes fully open.

B. Containment: Furnish and install laboratory fume hoods that are tested according to ASHRAE 110 at a release rate of 4.0 L/min. as follows:

1. Face Velocity Variation: Not more than 10 percent of average face velocity.
2. Sash Position: Fully open.
   a. For horizontal-sash units, test with maximum opening on one side, with maximum opening in the center, and with opening at each side equal to half of maximum opening.
   b. For combination-sash units, test with sash fully raised, with maximum opening on one side, with maximum opening in the center, and with opening at each side equal to half of maximum opening.

C. Static-Pressure Loss: Not more than 93 Pa (3/8-inch wg) at 0.51-m/s (100-fpm) face velocity when tested according to SEFA 1.2.

1.4 QUALITY CONTROL

A. Manufacturer Qualifications: Manufacturer regularly and presently manufactures laboratory fume hoods and has tested its products according to ASHRAE 110.

B. Electrical Components and Devices: UL listed and labeled for intended use.

1.5.SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data: Include the following:

1. Illustrations and descriptions of laboratory fume hoods and factory-installed devices for fume hoods.
2. Catalog or model numbers for each item incorporated into the work.
3. Static-pressure losses and exhaust volumes for fume hoods.
4. Results of testing according to ASHRAE 110.

C. Shop Drawings: Show details of fabrication, installation, adjoining construction, coordination with mechanical and electrical work, anchorage, and other work required for complete installation.

D. Field Test Reports: Indicate dates and times of tests and certify test results.

E. Operating Instructions: Comply with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

F. Shop drawings shall be submitted for Architectural and Engineering review for coordination of factory and/or field installed services.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

110-1995.....Method of Testing Performance of Laboratory Fume Hoods

C. Scientific Equipment and Furniture Association (SEFA):

1-2006.....Recommended Practices for Laboratory Fume Hoods

2-1999.....Recommended Practices for Installation of Scientific Laboratory Furniture and Equipment

PART 2 - PRODUCTS

2.1 Auxiliary-air Fume hoods

A. Airflow Systems: Auxiliary air.

B. Manufacturer: Fume hoods by Labconco as distributed by VWR International, Inc. or acceptable equivalent as approved by the VA.

C. Liners and Work Surfaces: Epoxy resin.

D. Sinks: Epoxy resin.

1. Cup Sinks: Equip with DN 40 (NPS 1-1/2) tailpieces, sink stoppers, and P traps.

2. Laboratory Sinks: Equip with DN 40 (NPS 1-1/2) sink outlets, sink stoppers, beehive overflows, and P traps.

E. Lighting Fixtures: Vaporproof.

G. Blowers: Remote for supply and exhaust air; supply sized based on 50 percent supply make up; remote sized to create exhaust air volume that produces average face velocity indicated with sashes fully open.

G. Sashes: Vertical and Horizontal type; fully tempered safety glass.

1. Accessories: Sash stops.

H. Bases: Table and Cabinet type.

I. Hoods:

1. Benchtop hood:

a. Labconco, Protector Premier Laboratory Hood.

2. Walk-in hood:

b. Labconco, Protector XL Floor Mounted Laboratory Hood.

J. Options:

1. Provide blank-off plate for variable air volume function of hood.

PART 3 - EXECUTION

3.1 INSTALLATION

Install laboratory fume hoods to comply with SEFA 2.

3.2 TESTS

A. Field test installed laboratory fume hoods according to ASHRAE 110 to verify compliance with performance requirements for containment.

1. For units that fail testing, make adjustments and corrections to installation, or replace fume hoods, and repeat tests until fume hoods comply with requirements.

3.3 PROTECTING AND CLEANING

A. Protect equipment from dirt, water, and chemical or mechanical injury during the remainder of the construction period.

B. At the completion of work, clean equipment as required to produce ready-for-use condition.

3.4 INSTRUCTIONS

Instruct personnel and transmit operating instructions in accordance with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 11 53 53
SAFETY STORAGE CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies safety storage cabinets.

1.2 RELATED WORK

A. Deduct Alternate No 2: Section 01 00 00, GENERAL REQUIREMENTS

B. Ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS.

C. Electrical Connections: Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).

D. Electrical Devices: Section 26 27 26, WIRING DEVICES.

1.3 QUALITY CONTROL

A. Manufacturer Qualifications: Manufacturer regularly and presently manufacturers safety storage cabinets.

B. NSF Compliance: Equipment bears NSF Certification Mark indicating compliance with NSF 49.

C. Electrical Components and Devices: UL listed and labeled for intended use.

1.4 SUBMITTALS

A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data: Include the following:

1. Illustrations and descriptions of safety storage cabinets.
2. Catalog or model numbers for each item incorporated into the work.
3. Utility requirements.

C. Shop Drawings: Show details of fabrication, installation, adjoining construction, coordination with mechanical and electrical work, anchorage, and other work required for complete installation.

D. Field Test Reports: Indicate dates and times of tests and certify test results.

E. Operating Instructions: Comply with requirements in specification.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):

WD 6-2002.....Wiring Devices--Dimensional Specifications

D. Scientific Equipment and Furniture Association (SEFA):
2-1999.....Recommended Practices for Installation of Scientific Laboratory Furniture and Equipment

PART 2 - PRODUCTS

2.1 CABINETS

A. Manufacturer: Justrite as distributed by VWR International, Inc. or equal as approved by VA.
1. Justrite vertical drum storage cabinet Model No. 896270 and 899060.

B. Accessories:
1. Drum Cabinet Ramp Model No. 25932. Provide one for each cabinet.

PART 3 - EXECUTION

3.1 PREPARATION

Install safety storage cabinets after installation of finish flooring in rooms to receive cabinets has been completed.

3.2 INSTALLATION

A. General:
1. Install safety storage cabinets according to manufacturer's written instructions and relevant requirements in SEFA 2.3.
2. Coordinate installation with related mechanical and electrical work. Provide cutouts and openings for plumbing and electrical work as indicated or as required by trades involved.

B. Cabinets:
1. Install level, plumb, true, and straight without distortion.
a. Shim cabinets using concealed shims.
2. Adjust hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended in writing by manufacturer.

3.3 TESTING

After installation, test safety cabinets for compliance to equipment requirements.

3.4 PROTECTING AND CLEANING

A. Protect equipment from dirt, water, and chemical or mechanical injury during the remainder of the construction period.

B. At the completion of work, clean equipment as required to produce ready-for-use condition.

3.5 INSTRUCTIONS

Instruct personnel and transmit operating instructions in accordance with requirements in specification.

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SECTION 12 31 00
MANUFACTURED METAL CASEWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies metal casework and related accessories, including base cabinets, wall cabinets, and full height cabinets.

B. Items specified in this section:

1. Laboratory and Hospital Casework.

1.2 RELATED WORK

A. Deduct Alternate No 2: Section 01 00 00, GENERAL REQUIREMENTS

B. Color of casework finish: Section 09 06 00, SCHEDULE FOR FINISHES.

C. Electrical Components: Division 26, ELECTRICAL.

1.3 QUALITY ASSURANCE

A. Approval by Contracting Officer of proposed manufacturer, or suppliers, will be based upon submission by Contractor certification that, manufacturer regularly and presently manufactures casework specified as one of their principal products.

B. Installer has technical qualifications, experience, trained personnel, and facilities to install specified items.

C. Furnish supervision of installation at construction site by a qualified technician regularly employed by casework installer.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Certificates:

1. Manufacturer's Certificate of qualifications specified and finish on casework.
2. Contractor's Certificate of installer’s qualifications specified.
3. Safety glass meets requirements of ANSI Standard Z97.1.

C. Manufacturer's Literature and Data:

1. Brochures showing name and address of manufacturer, and catalog or model number of each item incorporated into the work.
2. Manufacturer's illustration and detailed description.
3. List of deviations from contract specifications.
4. Locks, each kind

D. Shop Drawings (1/2 Full Scale):

1. Showing details of casework construction, including kinds of materials and finish, hardware, accessories and relation to finish of

adjacent construction, including specially fabricated items or components.

2. Fastenings and method of installation.
3. Location of service connections and access.

E. Samples:

1. Metal plate, 150 mm (six inch) square, showing chemical resistant finish, in each color.
2. One complete casework assembly, including cabinet(s) with drawers and cupboard.
3. One glazed sliding door with track and pertinent hardware. A complete cabinet may be submitted to fulfill this requirement.
4. Cabinets for subsequent installation may be submitted for above requirements.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Society for Testing and Materials (ASTM):

A36/A36M-05.....Carbon Structural Steel
A167-99(R 2004).....Stainless and Heat-Resisting Chromium Steel Plate Sheet and Strip
A283/A283M-03(R 2007)...Low and Intermediate Tensile Strength Carbon Steel Plates
A366/A366M-97(E 1998)...Commercial Steel (CS), Carbon, Cold-Rolled-Replaced by ASTM A1008/A1008M
A568/A568M-07.....Steel, Sheet, Carbon and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled, General Requirements
B456-03.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
C1036-06.....Flat Glass

C. American National Standard Institute:

Z97.1-04.....Safety Glazing Material used In Buildings

D. Builders Hardware Manufacturers Association (BHMA):

A156.1-06.....Butts and Hinges
A156.9-03.....Cabinet Hardware
A156.5-02.....Auxiliary Locks and Associated Products
A156.11-04.....Cabinet Locks
A156.16-02.....Auxiliary Hardware

E. American Welding Society (AWS):

D1.1-06.....Structural Welding Code Steel

D1.3-98.....Structural Welding Code Sheet Steel

F. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-505-88 Series...Metal Finishes Manual

G. U.S. Department of Commerce, Product Standard (PS):

PS 1-95.....Construction and Industrial Plywood

H. Federal Specifications (Fed. Spec.):

FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castle Knurled, Welding and Single Ball Seat

A-A-55615.....Shield, Expansion; Nail Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Steel:
   1. ASTM A366, cold rolled, Class 1 finish, stretcher leveled.
   2. Other types of cold rolled steel meeting requirements of ASTM A568 may be used for concealed parts.

B. Structural Steel: ASTM A283 or ASTM A36.

C. Stainless Steel: ASTM A167, Type 302B.

D. Glass:
   1. ASTM C1036 Type I, Class 1, Quality q3,
   2. For Doors: 6 mm (1/4 inch) thick; except where laminated glass is shown.
   3. For shelves: Either 6 mm (1/4 inch) or 9 mm (3/8 inch) thick.

E. Laminated Glass: Fabricate of two sheets of 3 mm (1/8 inch) thick clear glass, laminated together with a 1.5 mm (0.060 inch) thick vinyl interlayer, to a total overall thickness of 8 mm (5/16 inch).

F. Glazing Cushions:
   1. Channel shaped, of rubber, vinyl or polyethylene plastic, with vertical flanges not less than 2 mm (3/32 inch) thick and horizontal web 3 mm (1/8 inch) thick.
   2. Flanges may have bulbous terminals above the glazing heads or terminate flush with top of beads.

H. Fasteners:
   1. Exposed to view, chrome plated steel or stainless steel, or finished to match adjacent surface.
   2. Use round head or countersunk fasteners where exposed in cabinets.
   3. Expansion Bolts: Fed Spec. A-A-55615. Do not use lead or plastic shields.
   4. Nuts: Fed Spec FF-N-836. Type III, Style 15 where exposed.

5. Sex Bolts: Capable of supporting twice the load.

2.2 MANUFACTURED PRODUCTS

A. Drawings, specifications, model numbers, etc. shown or indicated are based upon casework distributed by VWR International

B. Single Source Responsibility: Provide all casework produced by a single manufacturer for each casework type and to the extent reasonable by the same manufacturer for all items specified in this Section

C. When two or more units are required, use products of one manufacturer.

D. Manufacturer of equipment assemblies, which include components made by other, shall assume complete responsibility for the final assembled unit.

E. Constituent parts which are alike, use products of a single manufacturer.

2.3 CASEWORK FABRICATION

A. General:

1. Welding: Comply with AWS Standards.
2. Reinforce with angles, channels, and gussets to support intended loads, notch tightly, fit and weld joints.
3. Constructed of sheet steel, except where reinforcing required.

B. Minimum Steel Thickness:

0.89 mm (0.035 inch) (20 gage)	Drawer fronts, backs, bodies, closure plates or scribe and filler strips less than 75 mm (three inches) wide, sloping top, shelf reinforcement channel and shelves. Toe space or casework soffits and ceilings under sloping tops.
1.20 mm (0.047 inch) (18 gage)	Base pedestals, casework top sides, back, and bottom panels, closure scribe and filler strips 75 mm (three inches) or more. Reinforcement for drawers with locks. Tables legs, spreaders and stretchers, when fabricated of cold rolled tubing. Metal for desks; except legs and aprons. Door exterior and interior panels, flush or glazed. Cross rails of base units. Front bottom rails, back bottom rails; rails may be 1.49 mm (0.059 inch) (16 gage) thick. Uprights or posts. Top corner gussets.
1.49 mm (0.059 inch) (16 gage)	Aprons, apron division, reinforcing gussets, table legs, desk legs and aprons, spreaders and stretchers when formed without welding. Toe base gussets, drawer slides, and other metal work. Front top rails and back rails except top back rails may be 1.2 mm (0.047 inch) (18 gage) thick.
1.88 mm (0.074 inch) (14 gage)	Drawer runners door tracks.

2.64 mm (0.104 inch) (12 gage)	Base unit bottom corner gussets and leg sockets.
3 mm (0.12 inch) (11 gage)	Reinforcement for hinge reinforcement inside doors and cabinets.

C. Casework Construction:

1. Welded assembly.
2. Fabricate with enclosed uprights or posts full height or width at front, include sides, backs, bottoms, soffits, ceilings under sloping tops, headers and rail, assembled to form an integral unit.
3. Form sides to make rabbeted stile 19 to 28 mm (3/4 to 1-1/8 inch) wide, closed by channel containing shelf adjustment slots.
4. Make bottom of walls units flush, double panel construction.
5. Make top and cross rails of "U" shaped channel.
6. Provide enclosed backs and bottoms in cabinets, including drawer units.
7. Provide finish panel on exposed cabinet backs.
8. Do not use screws and bolts in construction or assembly of casework, except to secure hardware, applied door stops, accessories, removable panels and where casework is required to fastened end to end or back to back.
9. Fabricate casework, except benches, and desks with finished end panels.
10. Close flush exposed soffits of wall hung shelving, knee spaces in counters, and toe spaces at bases.
11. In base units with sinks provide one piece, lowered backs.
12. In base units with doors provide removable backs.
13. Provide built-in raceways or tubular or channel shaped members of casework for installation of wiring and electric work. Mount junction boxes on rear of cabinets, Electric work is specified in electrical sections of specifications.
14. Provide reinforcing for hardware.
15. Size Dimensions:
    a. Used dimensions shown or specified within tolerances specified.
    b. Tolerance:
        1) Depth: 325 mm (13 inches) in lieu of 300 mm (12 inches), 450 mm (18 inches) in lieu of 400 mm (16 inches), except wall hung units above counter. 525 mm (21 inches) to 600 mm (24 inches) in lieu of 550 mm (22 inches).

2) Width: Minus 25 mm (one inch).
3) Height: 25 mm (one inch) plus or minus for wall hung cabinets and counter mounted cabinets, excluding sloping tops. 25 mm (one inch) plus for floor standing cabinets, excluding base and sloping tops. Full height cabinets shown back to back same height.
4) Manufacturer's tolerance for the same length, depth or height: Not to exceed 1.58 mm (0.0625 inches).

D. Base Pedestals:
1. Provide adjustable leveling bolts accessible through stainless steel plugs, or notch in the base concealed when resilient base is applied.
2. Except where flush metal base is shown, provide toe space at front recessed 75 mm (3 inches).

E. Doors:
1. Hollow metal type, flush and glazed doors not less than 16 mm (5/8 inch) thick.
2. Fabricate flush metal doors of two panels formed into pans with corners welded and ground smooth. Provide flush doors with a sound deadening core.
3. Fabricate glazed metal doors with reinforced frame and construct either from one piece of steel, or have separate stiles and rails mitered and welded at corners, and welds ground smooth.
   a. Secure removable glazing members with screws to back of doors.
   b. Install glass in rubber or plastic glazing channels.
4. Provide sheet steel hinge reinforcement inside doors.
5. Sliding doors: Provide stops to prevent bypass.
6. Doors removable without use of tools except where equipped with locks.

F. Drawers:
1. Drawer fronts flush hollow metal type not less than 16 mm (5/8 inch) thick with sound deadening core. Fabricate of two panels formed into pans. Weld and grind smooth corners of drawer fronts.
2. Form bodies from one piece of steel, weld to drawer front.
3. Provide reinforcement for locks and provide rubber bumpers at both sides of drawer head to cushion closing.
4. Equip with roller suspension guides.

G. Sloping Tops:
1. Provide sloping tops for casework where shown.
2. Where ceilings interfere with installation of sloping tops. Provide filler plates as specified.

3. Omit sloping tops or filler plates whenever ceiling material is turned down and furred-in at face of casework.
4. Provide exposed ends of sloping tops with flush closures.
5. Fasten sloping tops with sheet metal screws inserted from cabinet interior; space fastener as recommended by manufacturer.

H. Shelves:
1. Capable of supporting an evenly distributed minimum load of 122 kg/m^2 (twenty-five pounds per square foot) without visible distortion.
2. Flange shelves down 19 mm (3/4 inch) on edges, with front and bearing edges flanged back 13 mm (1/2 inch).
3. For shelves over 1050 mm (42 inches) in length and over 300 mm (12 inches) in depth install 38 mm by 13 mm by 0.9 mm (1-1/2 x 1/2 x 0.0359 inch) thick sheet steel hat channel reinforcement welded to underside midway between front and back and extending full length of shelf.
4. Weld shelves to metal back and ends unless shown adjustable.
5. Provide means of positive locking shelf in position, and to permit adjustment without use of tools.
6. On pharmacy on sloping shelf provide 13 mm (1/2 inch) wide clear acrylic plastic raised edge, 3 mm (1/8 inch) thick, secured to front edge of shelf.

I. Undercounter Table and Bench Frames:
1. Using welded construction.
2. Open frame type with aprons and legs when required.
3. Aprons:
   a. Channels shaped welded at corners, with leg sockets and reinforcing triangular corner gussets welded in corners.
   b. Pierce sockets to receive leg bolts and notch gussets to receive legs.
   c. Upper flange perforated or slotted to receive screws at 200 mm (8 inch) centers, and back channels when installed against wall. Size slots for 6 mm (1/4 inch) anchor bolts.
   d. Pierce aprons to receive drawer formation, rail at top of drawer opening. Install channel shaped apron division welded at ends, 762 mm 30 inches apart to front and back aprons, or at each side of drawer.
   e. Fabricate metal components from sheet steel.
      1) Use 1.5 mm (0.0598 inch) thick sheet for gussets and channel aprons.
      2) Use 1.2 mm (0.0478 inch) thick sheet for other items.

f. At knee space, provide exposed metal sides and metal closure plate for soffit. Where shown at knee space, provide exposed metal back secured with continuous angle closures at both side.

4. Legs:
   a. Cold rolled tubing or 1.5 mm (0.0598 inch) formed steel.
   b. Leveling-anchoring device at floor.
   c. Stud bolt at top for attachment to leg socket.
5. Leg Braces:
   a. Tables and benches not anchored to walls.
   b. Brace back against front legs near bottom with steel angle, channel or tubular braces.
   c. Fasten braces together with steel straps.
6. Leg Shoes:
   a. Fit laboratory casework legs at bottom with either stainless steel, aluminum, or chromium plated brass shoes, not less than 25 mm (one inch) in height.
   b. Fit other legs with a movable molded vinyl shoe 100 mm (four inches) high and coved at bottom.

J. Closures and Filler Strips at Pipe Spaces:
1. Flat steel strips or plates.
2. Openings less than 200 mm (8 inches) wide: 1.2 mm (0.047 inch) thick.
3. Openings more than 200 mm (8 inches wide 0.9 mm (0.359 inches) wide.

2.4 ACCESSORIES

A. Card or Label Holders for Shelves:
1. Fabricate of 0.6 mm (0.0239 inch) thick steel approximately 125 mm (five inches) long, or continuous where shown, having top and bottom edges bent over on face and welded to shelf.
2. Finish exposed surfaces in same color as shelf.

B. Labels Holders for Doors and Drawers:
1. Cast or wrought brass or aluminum, 50 mm (2 inch) by 88 mm (3-1/2 inch).
2. Fasten to casework as recommended by manufacturer.

C. Shadow Boards in Cabinet VL 33:
1. Plywood of size and thickness shown with exposed edges chamfered.
2. Secure boards to back of exterior metal doors and cabinet back with screws.
3. Use pivot top and bottom hinges on intermediate boards with pulls on each leaf.
4. Paint exposed surfaces of shadow boards two shop coats of shellac.

2.5 HARDWARE

A. Factory installed.

B. Exposed hardware, except as specified otherwise, satin finished chromium plated brass or nickel plated brass or anodized aluminum.

C. Cabinet Locks:

1. Where locks are shown.
2. Locked pair of hinged door over 900 mm (36 inches) high:
   a. ANSI/BHMA A156.5, similar to E0261, Key one side.
   b. On active leaf use three-point locking device, consisting of two steel rods and lever controlled cam at lock, to operate by lever having lock cylinder housed therein.
   c. On inactive leaf use dummy lever of same design.
   d. Provide keeper holes for locking device rods and cam.
   e. Use two point locking device both doors of cabinet 6D similar to ANSI/BHAMA A156.5, E0251, Key one side.
3. Door and Drawer: ANSI/BHMA A156.11 cam locks.
   a. Drawer and Hinged Door up to 900 mm (36 inches) high: E07261.
   b. Pin-tumbler, cylinder type lock with not less than four pins. Disc tumbler lock "duo A" with brass working parts and case, as manufactured by Illinois Lock Company are acceptable.
   c. Sliding Door: E07161.
4. Key locks differently for each type casework and master key for each service.
   a. Provide two keys per lock.
   b. Provide six master keys per service.
5. Marking of Locks and Keys:
   a. Name of manufacturer, or trademark which can readily be identified legibly marked on each lock and key change number marked on exposed face of lock.
   b. Key change numbers stamped on keys.
   c. Key change numbers to provide sufficient information for manufacturer to replace key.

D. Cabinet Hardware: ANSI BHMA A156.9.

1. Door/Drawer Pulls: B02011.
   a. One for drawers up to 575 mm (23 inches) wide.
   b. Two for drawers over 575 mm (23 inches) wide.
   c. Sliding door flush pull, each door: B02201.
2. Door in seismic zones: B03352.
   a. Do not provide thumb latch on doors equipped with three point locking device.

b. Use lever operated two point latching device on paired doors over 900 mm (36 inches) high if three point locking or latching device is not used.

3. Cabinet Door Catch:
   a. Install at bottom of wall cabinets, top of base cabinets and top and bottom of full height cabinet doors over 1200 mm (48 inches).
   b. Omit on doors with locks.
4. Drawer Slides:
   a. Use B05051 for drawers over 150 mm (6 inches) deep.
   b. Use B05052 for drawers 75 to 150 mm (3 to 6 inches) deep.
   c. Use B05053 for drawers less than 75 mm (3 inches) deep.
5. BUTT HINGES:
   a. B01351, minimum 1.8 mm (0.072 inch) thick chrome plated steel leaves.
   b. Minimum 3.5 mm (0.139 inch) diameter stainless steel pins.
   c. Full mortise type, five knuckle design with 63 mm (2-1/2 inch) high leaves and hospital type tips.
   d. Two hinges per door except use three hinges on doors 1200 mm (48 inches) and more in height. Use stainless steel leaves for tilting bin doors.
   f. Do not weld hinges to doors or cabinets.
6. Pivot hinges: ANSI/BHMA A156.1 A875B.
7. Shelf Supports:
   a. install in casework where adjustable shelves are noted.
   b. Adjustable Shelf Standards: B04061 with shelf rest B04081.
   c. Vertical Slotted Shelf Standard: B04102 with shelf brackets B04112 sized for shelf depth.
8. Sliding Doors:
   a. Doors supported by two ball bearing bronze or nylon rollers or sheaves riding on a stainless steel track.
   b. Sliding Door Tracks: B07093. Plastic tracks not acceptable.
   c. Doors restrained by a nylon, polyvinylchloride, or stainless steel guide at opposite end.
9. Auxiliary Hardware: ANSI A156.16.
10. Door silencers: LO3011 or LO3031.
    a. Install two rubber bumpers each door.
    b. Silencers set near top and bottom of jamb.
11. Closet Bar: L03131 chrome finish of required length.

2.6 METAL FINISHES

A. Comply with NAAMM 500 series and as specified.

B. Steel Cabinets including Closures and Filler Strips:
   1. Acid resisting finish except hardware and stainless steel.
   2. After fabrication of cabinet submerge in a degreasing bath, and thoroughly rinse to remove dirt and grease, and other foreign matter.
   3. Apply non-metallic phosphate coating, then finish with baked-on acid resisting enamel not less than one mil thick.
   4. Finish resistant to action of the following reagents when 10 drops (0.5 cm^3) are applied to the surface and left open to the atmosphere for period of one hour.

Hydrochloric Acid 37 percent	Ethyl Alcohol
Phosphoric Acid 75 percent	Methylethyl Keytone
Sulfuric Acid 25 percent	Acetone
Glacial Acetic Acid	Ethyl Acetate
Sodium Hydroxide 10 percent	Ethyl Ether
Sodium Hydroxide (concentrated)	Carbon Tetrachloride
Ammonia Hydroxide (concentrated)	Xylene
Hydrogen Peroxide 5 percent	Phenol 85 Percent
Formaldehyde 37 percent	

   5. Color of finish is specified in Section, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULES.

C. Brass:
   1. U.S. Standard Finish No. 26 for hardware items.
   2. Other brass items: ASTM B456, chromium plated finish meeting requirements for Service Condition SCI.

D. Aluminum: Chemically etched medium matte, clear anodic coating, Class II, Architectural, 0.4 mils thick.

E. Stainless Steel: Mechanical finish No. 4 on sheet except No. 7 on tubing.

2.7 DISPENSING TRAYS AND BINS

A. Design trays and bins to fit cabinets where shown.

B. Fabricate of steel, polypropylene, fiberglass reinforced polyester resin, or other suitable material.

C. Lock securely in place without the use of tools.

D. Fit at angle to provide gravity feed where shown.

E. Dispensing Trays:
   1. Equip trays with two longitudinal dividers adjustable to three position.

2. Approximate dimensions: 150 mm (6 inches) in width 75 mm (3 inches) in depth, and length to suit cabinets depth furnished.

F. Dispensing Bins:

1. Open front, except for retaining rim.
2. Approximate dimensions: 150 mm (6 inches) in width, 125 mm (5 inches) in depth, and length to suit cabinets furnished.

2.7 ELECTRICAL FIXTURES

A. Comply with requirements of Division 26 - ELECTRICAL specifications for fixtures, receptacles, wiring and junction boxes required for fixtures and receptacles, included with casework.

B. Suitable for use with electrical system specified and shown.

PART 3 - EXECUTION

3.1 COORDINATION

A. Before installing casework, verify wall and floor surfaces covered by casework have been finished.

B. Verify location and size of mechanical and electrical services as required.

C. Verify reinforcement of walls and partitions for support and anchorage of casework.

3.2 FASTENINGS AND ANCHORAGE

A. Do not anchor to wood ground strips.

B. Provide hat shape metal spacers where fasteners span gaps or spaces.

C. Use 6 mm (1/4 inch) diameter toggle or expansion bolts, or other appropriate size and type fastening device for securing casework to walls or floor. Use expansion bolts shields having holding power beyond tensile and shear strength of bolt and breaking strength of bolt head.

D. Use 6 mm (1/4 inch) diameter hex bolts for securing cabinets together.

E. Use 6 mm (1/4 inch) by minimum 38 mm (1-1/2 inch) length lag bolt anchorage to wood blocking for concealed fasteners.

F. Use not less than No. 12 or 14 wood screws with not less than 38 mm (1-1/2 inch) penetration into wood blocking.

G. Space fastening devices 300 mm (12 inches) on center with minimum of three fasteners in 900 or 1200 mm (three or four foot) unit width.

H. Anchor floor mounted cabinets with a minimum of four bolts through corner gussets. Anchor bolts may be combined with or separate from leveling device.

I. Secure cabinets in alignment with hex bolts or other internal fastener devices removable from interior of cabinets without special tools. Do not use fastener devices which require removal of tops for access.

J. Where units abut end to end anchor together at top and bottom of sides at front and back. Where units are back to back anchor backs together at corners with hex bolts placed inconspicuously inside casework.

K. Where type, size, or spacing of fastenings is not shown or specified, show on shop drawings proposed fastenings and method of installation.

3.3 CLOSURES AND FILLER PLATES

A. Close openings larger than 6 mm (1/4 inch) wide between cabinets and adjacent walls with flat, steel closure strips, scribed to required contours, or machined formed steel fillers with returns, and secured with sheet metal screws to tubular or channel members of units, or bolts where exposed on inside.

B. Where ceilings interfere with installation of sloping tops, omit sloping tops and provide flat steel filler plates.

1. Secure filler plates to casework top members, unless shown otherwise.
2. Secure filler plates more than 150 mm (six inches) in width top edge to a continuous 25 by 25 mm (one by one inch) 0.889 mm thick steel formed steel angle with screws.
3. Anchor angle to ceiling with toggle bolts.

C. Install closure strips at exposed ends of pipe space and offset opening into concealed space.

D. Paint closure strips and fillers with same finishes as cabinets.

E. Caulk and seal laboratory furniture as specified in Section 07 92 00, JOINT SEALANTS.

3.4 CABINETS

A. Install in available space; arranged for safe and convenient operation and maintenance.

B. Align cabinets for flush joints except where shown otherwise.

C. Install cabinets level with bottom of wall cabinets in alignment and tops of base cabinets aligned.

D. Install corner cabinets with hinges on corner side with filler or spacers sufficient to allow opening of drawers.

E. Plug Buttons:

1. Install plug buttons in predrilled or prepunched perforations not used.
2. Use chromium plate plug buttons or buttons finish to match adjacent surfaces.

F. Cabinets 6D: Ground to nearest cold water pipe in accordance with NFPA, Underwriters Laboratories, Inc., or other nationally recognized laboratory approved ground specified system.

G. Cabinets PH77:

1. Install undercounter unit, PH77U, on base to bring cabinet to same height as adjacent cabinets.
2. Install wall hung units, PH77N, as for wall cabinets, bolt together with security type bolts.
3. Install stacked units, PH77D, bolted together and to base with security type bolts.

3.5 PROTECTION TO FIXTURES, MATERIALS, AND EQUIPMENT

A. Tightly cover and protect cabinets against dirt, water chemical or mechanical injury.

B. Thoroughly clean interior and exterior of cabinets, at completion of all work.

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SECTION 12 34 00
MANUFACTURED PLASTIC CASEWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interchangeable modular plastic casework system with countertops.

B. System includes support components, storage units, accessories, electrical wiring chases, for wall hung and island arrangements.

1.2 RELATED WORK

A. Instructions: SECTION 01 00 00, GENERAL REQUIREMENTS.

B. Deduct Alternate No 2: Section 01 00 00, GENERAL REQUIREMENTS

C. Backing plates for wall mounted items: SECTION 09 22 16, NON-STRUCTURAL METAL FRAMING.

D. Colors, patterns and finishes selected: SECTION 09 06 00, SCHEDULE FOR FINISHES.

E. Other metal caseworks: SECTION 12 31 00, MANUFACTURED METAL CASEWORK.

F. Countertop construction and materials and items installed in countertops: SECTION 12 36 00, COUNTERTOPS.

G. Plumbing requirements: DIVISION 22, PLUMBING.

H. Electrical requirements: DIVISION 26, ELECTRICAL.

1.3 SUBMITTALS

A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product data:

1. Manufacturer’s literature and other data showing compliance with the specification.
2. List of 3 similar projects completed within last 5 years with names and addresses.

C. Certification:

1. Manufacturer’s qualifications specified.
2. Installer’s qualifications specified.

D. Shop drawings:

1. Drawings complete, accurate and to scale.
2. Show:
   a. Location of each component.
   b. Dimensions and clearance as required.
   c. Identify each component with both drawing identification and manufacturer’s product number.

d. Details including cuts, holes, scribes, attachments and specialized construction requirements.

3. Installation procedures: Show dimensions, methods of assembly, anchorage, installation and conditions relating to adjoining work.
4. Placement Listing: Itemized listing by room number of components provided.
5. Complete listing of each component used.
6. Include the weight of each component.

E. Samples:

1. Support rail, 1200 mm (48 inches) long.
2. Wall strip two pieces each, 1200 mm (48 inches) long.
3. Storage unit, drawers with countertop each type.
4. Storage unit, tambour door.
5. Process table.
6. Shelf unit, open.
7. Shelf unit, closed.
8. Mobile storage cart.
9. Typical service module.

F. Operational and Maintenance Manual

1.4 QUALITY ASSURANCE

A. Approval by Contracting Officer is required of manufacturer and installer based upon certification of qualifications specified.

B. Manufacturer’s qualifications:

1. Manufacturer is regularly engaged in design and manufacture of modular plastic casework, casework components and accessories of scope and type similar to requirements of this project for a period of not less than 5 years.
2. Manufacturer has successfully completed at least 3 projects of scope and type similar to requirements of this project.

C. Installer Qualifications:

1. Installer is approved by modular plastic casework manufacturer.
2. Installer has completed at least 3 projects in last 5 years in which these products were installed.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle to prevent damage and deterioration until final acceptance of project.

B. Deliver and store materials in manufacturer’s original, labeled containers after building is enclosed and wet work is complete and dry.

C. Store materials in a secure, locked area.

D. Repair or replace damaged items due to storage or handling.

1.6 WARRANTY

Warranty casework system components against structural failure of components, disassembly of cabinets, shelves and countertops subject to terms of "Warranty of Construction" article specified in FAR clause 52.246-21, except that warranty period shall be 5 years.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation.

B. American Hardwood Association:
A135.4-04.....Basic Hardwood

C. American National Standards Institute (ANSI):
A208.1-99.....Particleboard

D. American Society for Testing and Materials (ASTM):
A36M-05.....Carbon Structural Steel
A167-99 (R2004).....Stainless and Heat-Resisting Chromium Steel Plate Sheet and Strip
A283/A283M-03(R 2007)...Low and Intermediate Tensile Strength Carbon Steel Plates
A366/A366M-97(E 1998)...Steel Sheet, Carbon Cold-Rolled, Commercial Quality
A423/A423M-95(R 2004)...Seamless and Electric-Welded Low-Alloy Steel Tubes
A568/A568M-07.....Steel, Sheet, Carbon, Structural and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled, General Requirements
B221-06.....Aluminum and Aluminum-Alloy Extruded Bars, Rods Wire, Profiles and Tubes
B456-03.....Electrodeposited Coatings of Copper Plus, Nickel Plus Chromium and Nickel Plus Chromium
D1201-99 (R2004).....Polyester Thermosetting Molding Compound
D4673-02.....Acrylonitrite-Butadiene-Styrene (ABS) Molding and Extrusion Materials
E84-07.....Surface Burning Characteristics of Plastics and Alloys Building Materials

E. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-505-88.....Metal Finishes Manual

F. National Electrical Manufacturers Association (NEMA):
LD-3-05.....High Pressure Decorative Laminates
LD-3.1-95.....Performance, Application, Fabrication and Installation of High Pressure Decorative Laminates

G. National Fire Protection Association (NFPA):
70-07.....National Electric Code (NEC)

H. National Sanitation Foundation (NSF):
30-92.....Cabinetry and Laboratory Furniture for Hospitals

I. U.S. Department of Commerce, Product Standard (PS):
PS1-95.....Construction and Industrial Plywood

J. Scientific Equipment and Furniture Association (SEFA):
2-06.....Installation of Scientific Laboratory Furniture and Equipment

K. Underwriters Laboratories (UL): Annual Fire Resistance Directories

PART 2- PRODUCT

2.1 DESIGN REQUIREMENTS

A. Drawings, specifications, model numbers, etc. shown or indicated are based upon casework distributed by VWR International.

B. Components provided by one manufacturer. Products of other manufacturers used meet specified flexibility and interchangeability requirements.

C. Counter Tops and Work Surfaces:
1. Provide Plastic laminate work surfaces with round corners and impact resistant material on exposed edges.
2. Provide leveling adjustments capability so units can be brought into a level position.
3. Secured using mechanical fasteners. Show detail on shop drawings.

D. Finish:
1. Selected from manufactures standard colors, specification SECTION 09 06 00, SCHEDULE FOR FINISHES.
2. More than one color may be selected for units.
3. Steel components finished with chemical resistant paint.

E. Locks:
1. Manufactures standard design.
2. Drawers capable of locks into cabinets or lockable lids.
3. Cabinets capable of locking.

2.2 MATERIALS

A. Carbon Structural Steel: ASTM A36M

B. Stainless Steel: ASTM A167, Type 302B with number 4 finish minimum.

C. Steel plates: ASTM A283.

D. Sheet Steel: ASTM A366 or A568.

E. Steel Tubes: ASTM A423.

F. Aluminum: ASTM B221.

G. ABS compounds: ASTM D4673.

H. Plastic Laminate: NEMA LD-3.

I. Hardboard: AHA A135.4, Class 1, tempered.

J. Particleboard: ANSI A208.1.

2.3 FABRICATION

A. Manufacturer’s standard design of modular casework system meeting design requirements.

1. Casework requirements specified are intended to establish essential minimum requirements.
2. Dimensions of components shown are nominal to represent module requirements.
3. Provide components compatible with each other as to color, finish and hardware.

B. Components of ABS compounds, ASTM D4673, with integral color throughout and molded to manufacturer's standard system design.

C. Components stain and rust-resistant capable of withstanding washing temperatures up to 85 degrees C (185 degrees F) without distortion or physical imperfections.

D. Storage modules, plastic laminate exposed surfaces including interiors conforming to and fabricated in accordance with LD3.1, NSF 30, over plywood conforming to PS1 or not less than 641 Kg/ cubic meter (45 lbs. per cubic foot) particle board conforming to ANSI A 208.1.

F. Comply with NSF 30.

G. Finish metals in accordance with NAAMM AMP 500-505 and plated steel in accordance with ASTM B456 as standard with modular casework manufacturer’s system.

H. Fabricate steel components of ASTM A36M, A283, A366 or A568 as standard with casework system manufacturer.

I. Weld In accordance with ANSI D1.1 or D9.1 Finish welds smooth and free of sharp edges where exposed.

J. Plated Metal: Finish in accordance with ASTM B456 for steel products and NAAMM AMP 500-505.

K. Painted Steel: Finish in accordance with NAAMM AMP 500-505

L. Anodized Aluminum: Finish as standard with modular cabinet manufacturers system.

2.4 COUNTERTOPS

A. Exposed work surfaces finished with NEMA LD3 plastic laminate that meets or exceeds NEMA standards for vertical grade.

1. Fabricate in accordance with NEMA LD3.1 cores of exterior plywood, PS1 or particleboard ANSI A208.1, M2 or M3.

a. Tops and splashes: Textured finish, General purpose type, grade designation GP 50, 1.25 mm (0.05 inch) thickness or Post Forming type, grade designation PF42, 1.05 mm (0.042 inch) thickness for post forming, except with minimum wear resistance of 1200 cycles.

b. Backer sheet: Grade designation BK 20, 0.50 mm (0.020 inch) thickness.

c. Core 38 mm (1-1/2 inches) minimum thickness as standard with modular casework manufacture and exposed edge faced with plastic laminate not less than 38 mm (1-1/2 inches).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and adjoining construction and conditions under which work is to be installed.

B. Do not proceed with the work until unsatisfactory conditions detrimental to proper and timely completion of the work have been corrected.

3.2 SEQUENCING AND SCHEDULE

A. Begin only after work of other trades is complete, i.e., wall and floor finish completed, ceilings installed, light fixtures and diffusers installed and connected and area is free of trash and debris.

B. Fixed components may be installed in areas which can not be secured.

C. Install non-fixed components and accessories just prior to final inspection, unless areas where installation is complete is locked against entry.

D. Coordinate with DIVISION 21, FIRE SUPPRESSION, DIVISION 22, PLUMBING, DIVISION 23, HEATING, VENTILATING, AND AIR CONDITIONING,

DIVISION 26, ELECTRICAL, DIVISION 27, COMMUNICATIONS, and DIVISION 28, DIVISION ELECTRONIC SAFETY AND SECURITY trades to avoid interference and completion of service connections.

3.3 INSTALLATION

A. Assemble and install components in accordance with manufacturer's written instructions and recommendation and SEFA 2.3
B. Anchor fixed components firmly in position; square, level, plumb and properly connect using mechanical fasteners, wood or sheet metal screws are not permitted.
C. Perform cutting of components to receive work installed by others.
D. Support Rail Attachments:
   1. Install true to horizontal at heights shown; maximum tolerance for uneven floors is plus or minus 13 mm (1/2 inch).
   2. Shim as necessary to accommodate variations in wall surface not exceeding 5 mm (3/16 inch) at fastener.
E. Wall Strips:
   1. Install true to vertical and spaced as shown on installation drawing.
   2. Align slots to assure that hanging units will be level.
F. Furnish pipe supports in utility chases no closer than 1200 mm (48 inch) between centers.

3.4 ADJUSTMENTS

A. Adjust equipment to insure proper alignment and operation.
B. Replace or repair damaged or improperly operating materials, components or equipment.

3.5 CLEANING

A. Immediately following installation, clean each item, removing finger marks, soil and foreign matter resulting from work of this section.
B. Remove from job site trash, debris and packing materials resulting from work of this section.
C. Leave installed areas clean of dust and debris resulting from work of this section.

3.6 INSTRUCTIONS

A. Provide operational and cleaning manuals and verbal instructions in accordance with Article INSTRUCTIONS, SECTION 01 00 00, GENERAL REQUIREMENTS.

-----END-----

SECTION 12 36 00
COUNTERTOPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies casework countertops with integral accessories.

B. Integral accessories include:

1. Sinks with traps and drains.
2. Eye and Face Wash Units.
3. Mechanical Service fixtures.
4. Electrical Receptacles.

1.2 RELATED WORK

A. Color and patterns of plastic laminate: SECTION 09 06 00, SCHEDULE FOR FINISHES.

B. DIVISION 22, PLUMBING.

C. DIVISION 26, ELECTRICAL.

D. Equipment Reference Manual for SECTION 12 36 00, COUNTERTOPS.

1.3 SCOPE OF WORK

A. For all items of casework and laboratory equipment (stock floor and wall mounted cabinets, storage cabinets) listed in the specification and shown on drawings; unless otherwise noted include delivery to the designated spaces within the building, unpacking, setting in place, leveling and scribing to walls and floors, as required.

B. Install sinks, faucets, tailpieces, and strainers. Coordinate with vendor in order to verify and confirm all building dimensions relative to equipment to be furnished and installed by taking actual field measurements at the job site prior to equipment fabrication

1.4 SUBMITTALS

A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings

1. Show dimensions of section and method of assembly.
2. Show details of construction at 1/2 scale.

C. Samples:

1. 150 mm (6 inch) square samples each top.
2. Front edge, back splash, end splash and core with surface material and booking.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Hardboard Association (AHA):
A135.4-04.....Basic Hardboard

C. Composite Panel Association (CPA):
A208.1-99.....Particleboard

D. American Society of Mechanical Engineers (ASME):
A112.18.1-05.....Plumbing Fixture Fittings
A112.1.2-04.....Air Gaps in Plumbing System
A112.19.3-00(R2004).....Stainless Steel Plumbing Fixtures (Designed for Residential Use)

E. American Society for Testing and Materials (ASTM):
A167-99 (R2004).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
A1008-07.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength, Low Alloy
D256-06.....Pendulum Impact Resistance of Plastic
D570-98(R2005).....Water Absorption of Plastics
D638-03.....Tensile Properties of Plastics
D785-03.....Rockwell Hardness of Plastics and Electrical Insulating Materials
D790-07.....Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D4690-99(2005).....Urea-Formaldehyde Resin Adhesives
G21-96 (R2002).....Determining Resistance of Synthetic Polymeric Materials to Fungi

F. Federal Specifications (FS):
A-A-1936.....Adhesive, Contact, Neoprene Rubber

G. U.S. Department of Commerce, Product Standards (PS):
PS 1-95.....Construction and Industrial Plywood

H. National Electrical Manufacturers Association (NEMA):
LD 3-05.....High Pressure Decorative Laminates
LD 3.1-95.....Performance, Application, Fabrication, and Installation of High Pressure Decorative Laminates

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Drawings, specifications, model numbers, etc. shown or indicated are based upon casework distributed by VWR International and is intended to establish a standard quality of design.

B. In all locations on the drawings, where manufacturer standard model numbers are indicated, see details of casework items to determine additional custom construction requirements that also may apply to the item

2.2 MATERIALS

A. Plastic Laminate: NEMA LD 3.
   1. Concealed backing sheet Type BKL.
   2. Decorative surfaces:
      a. Flat components: Type GP-HGL.
      b. Post forming: Type PF-HGP.
   3. Chemical Resistant Surfaces
      a. Flat components: Type GP-HGL.
      b. Post forming: Type PF-HGP.
      c. Resistance to reagents:
         1) Test with five 0.25 mil drops remaining on surface for 16 hours followed by washing off with tap water, then cleaned with liquid soap and water, dried with soft cotton cloth and then cleaned with naphtha.
         2) No change in color, surface texture, and original protectability remaining from test results of following reagents:

98% Acetic Acid	Butyl Alcohol	Acetone
90% Formic Acid--	Benzine	Chloroform
28% Ammonium Hydroxide	Xylene	Carbon Tetrachloride
Zinc Chloride (Sat.)	Toluene	Cresol
Sodium Carbonate (Sat.)	Gasoline	Ether
Calcium Hypochlorite (Sat.)	Kerosene	Cottonseed Oil
Sodium Chloride (Sat.)	Mineral Oil	40% Formaldehyde
Methyl Alcohol	Ethyl Acetate	Trichlorethylene
Ethyl Alcohol	Amyl Acetate	Monochlorobenzine

3) Superficial effects only: Slight color change, spot, or residue only with original protectability remaining from test results of following reagents:

77% Sulfuric Acid	37% Hydrochloric Acid	85% Phenol
33% Sulfuric Acid	20% Nitric Acid	Furfural
85% Phosphoric Acid	30% Nitric Acid	Dioxane

4) Minimum height of impact resistance: 300 mm (12 inches).

B. Molded Resin:

1. Provide one inch thick top, molded from a modified epoxy resin with non porous surface with optimum physical and chemical resistance. The specially compounded and cured uniform mixture, throughout the thickness of the top, shall be non-glaring color selected from manufacturer's full range of colors. Exposed edges and corners shall be beveled and a drip groove shall be provided on under surface. Curbs, as indicated on drawings, shall be four inches high. Non-glare epoxy resin or furan resin compounded and cured for minimum physical properties specified:

Flexural strength	70 MPa (10,000 psi)	ASTM D790
Rockwell hardness	105	ASTM D785
Water absorption, 14 hours (weight)	.01%	ASTM D570

2. Material of uniform mixture throughout.

C. Adhesive

1. For plastic laminate FS A-A-1936.
2. For Field Joints:
   a. Epoxy type, resistant to chemicals as specified for plastic laminate laboratory surfaces.
   b. Fungi resistant: ASTM G-21, rating of 0.

D. Fasteners:

1. Metals used for welding same metal as materials joined.
2. Use studs, bolts, spaces, threaded rods with nuts or screws suitable for materials being joined with metal splice plates, channels or

2.2 SINKS

A. Stainless Steel:

1. ANSI/ASME A112.19.3, Type 304.
2. Self rim for plastic laminate or similar tops with concealed fasteners.

3. Stainless steel sinks shall be seamless die-drawn construction of 18 gauge, Type 304 stainless steel. Crumb strainers shall include removable basket and 1-1/2" X 4" tailpiece
4. Ledge back or ledge sides with holes to receive required fixtures when mounted on countertop.
5. Apply fire resistant sound deadening material to underside.

B. Stainless steel circular or oval shaped bowl.

2.3 TRAPS AND FITTINGS

A. Material as specified in DIVISION 22, PLUMBING.

B. For Stainless Steel Sinks:

1. Either cast or wrought brass or stainless steel P-traps and drain fittings; ASME A112.18.1
2. Flat strainer, except where cup strainer or overflow standpipe specified.
   a. Provide cup strainer in cabinet type 1B.
   b. Provide stainless steel overflow stand pipe to within 38 mm (1-1/2 inches) of sink rim.
3. Exposed surface chromium plated finish.

E. Air Gap Fittings: ASME A112.1.2.

2.4 WATER FAUCETS

A. ASME A112.18.1.

1. Forged brass, compression type with replaceable seat and stem assembly or replaceable cartridge.
2. Indexed blade handles either with or without head.
3. Gooseneck minimum clearance above countertop of 190 mm (7-1/2 inches) with vacuum breaker, bent 180 degrees for vertical discharge, provided with removable serrated hose end.
4. Swing spouts elevated to clear handles.
5. Exposed brass surfaces chromium plated.
6. Cast combination hot and cold fixture with one piece body for multiple outlets.
7. Adapter type connection which will permit field conversion of swing spouts to fixed or gooseneck grouts or vice versa.
8. Pedestals Top for Laboratory:
   a. Modern design tapered to a round base, factory assembled and tested.
   b. Brass shanks, locknuts and washers for attaching to top or curbs.

B. Laminar flow control device on spouts.

C. Automatic Controlled Faucets.

1. Infra-red photocell sensor and a solenoid valve to control water flow automatically.
2. Breaking light beam activates water flow.
3. Water stops when user moves away from light beam.

C. Laboratory Faucets:
1. Female 9 mm (3/8 inch) IPS threaded outlet for attachment of filter pumps, hose connectors, anti-hose nozzle, or laminar flow control device on spout end.
2. Provide angle type vacuum breaker for fixture, designed for low flow, with built-in floating disk and renewable seat in vacuum breaker body.

D. Deionized Water Fixture:
1. Deck mounted.
2. Gooseneck spout with handle arranged for self closing and with hold open feature to open and close an inert silicone diaphragm valve.
3. Faucet designed to be chemically insert and resistant to leaching of inorganic contaminates, enhancement of bacteria growth, and internal corrosion.

2.5 FIXTURE IDENTIFICATION

A. Code fixtures with full view plastic index buttons.

B. Use following colors and codes:

SERVICE	COLOR	CODE	COLOR OF LETTERS
Cold Water	Dark Green	CW	White
Hot Water	Red	HW	White
Deionized Water	White	DI	Black

2.6 ELECTRICAL RECEPTACLES

A. Hospital grade per electrical specifications.

B. Curb Mounted Receptacles:
1. NEMA 5-20R duplex in galvanized steel box.
2. Chromium plated brass or steel face plate.

C. Pedestal Mounted Receptacles:
1. NEMA 5-20R duplex installed in double faces.
2. Polished stainless steel or aluminum, or chromium plated brass pedestal.

2.7 COUNTERTOPS

A. Fabricate in largest sections practicable.

B. Fabricate with joints flush on top surface.

C. Fabricate countertops to overhang front of cabinets and end of assemblies 25 mm (one inch) except where against walls or cabinets.
D. Provide 1 mm (0.039 inch) thick metal plate connectors or fastening devices (except epoxy resin tops).
E. Join edges in a chemical resistant waterproof cement or epoxy cement, except weld metal tops.
F. Fabricate with end splashes where against walls or cabinets.
G. Splash Backs and End Splashes:
   1. Not less than 19 mm (3/4 inch) thick.
   2. Height 100 mm (4 inches) unless noted otherwise.
   3. Laboratories and pharmacy heights or where fixtures or outlets occur: Not less than 150 mm (6 inches) unless noted otherwise.
   4. Fabricate epoxy splash back in maximum lengths practical of the same material.
H. Drill or cutout for sinks, and penetrations.
   1. Accurately cut for size of penetration.
   2. Cutout for VL 81 photographic enlarger cabinet.
      a. Finish cutout to fit flush with vertical side of cabinet, allowing adjustable shelf to fit into cutout space of cabinet at counter top level. Finish cutout surface as an exposed edge.
      b. Provide braces under enlarger space to support not less than 45 kg (100 pounds) centered on opening side along backsplash.
I. Plastic Laminate Countertops:
   1. Fabricate plastic laminate on five-ply plywood or particleboard core 19 mm (3/4 inch) thick with plastic laminate backing sheet.
   2. Front edge over cabinets not less than 38 mm (1-1/2 inches) thick except where plastic "T" insert is used, not less than 19 mm (3/4 inch) thick.
   3. Exposed Surface and edges of decorative laminated plastic or laboratory chemical resistant surface.
      a. Use chemical resistant surface on tops 6A, 6B, and 6C.
J. Molded Resin Tops:
   1. Molded resin with drip groove cut on underside of overhanging edge.
   2. Finish thickness of top minimum 25 mm (1 inch).
   3. Joints: Epoxy Type.
   4. Secure reagent shelves to counter tops with fasteners from underside and seal seam.
K. Laboratory Shelf 200 mm (8 inches) deep: Fabricate of 27 mm (1-1/16 inch) thick hardwood. Finish with black acid resisting enamel.

L. Laboratory Shelf with Funnel and Graduate Rack 300 mm (12 inches) deep shelf: Fabricate of 27 mm (1-1/16 inch) thick hardwood. Finish with black acid resisting enamel.

M. Laboratory Shelf 254 mm (10 inch deep): Fabricate of corrosion resisting steel.

N. Counter Tops for Interchangeable Furniture: Counter tops, unless otherwise shown, are to be capable of vertical adjustment of 150 mm (6 inches). Fabricate tops, except CRS, in increments of units over which they fit with maximum length not to exceed 1950 mm (78 inches). Top section shall cover as many cabinet units as possible. Horizontal joints in counter tops at service strip and across depth of counter are be watertight when in place but of a type that can be easily separated and reset when counter top is moved up or down. Fabricate CRS tops in maximum lengths practicable, with field joints welded and ground smooth to match adjacent surfaces. Securely fasten to supporting rails with heavy metal fastening devices, or with screws, through pierced slots in such rails. Fabricate vertical splash back and reagent shelf in maximum length practicable of same material as working surface, except finish thickness shall be 19 mm (3/4 inch).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installing countertops verify that wall surfaces have been finished as specified and that mechanical and electrical service locations are as required.

B. Secure countertops to supporting rails of cabinets with metal fastening devices, or screws through pierced slots in rails.

1. Where type, size or spacing of fastenings is not shown or specified, submit shop drawings showing proposed fastenings and method of installation.
2. Use round head bolts or screws.
3. Use epoxy or silicone to fasten the epoxy resin countertops to the cabinets.
4. Use wood or sheet metal screws for wood or plastic laminate tops; minimum penetration into top 16 mm (5/8 inch), screw size No 8, or 10.

C. Rubber Moldings:

1. Where shown install molding with butt joints in horizontal runs and mitered joints at corners where ceramic tile occurs omit molding.
2. Fasten molding to wall and to splashbacks and splashends with adhesive.

D. Sinks
   1. Install stainless steel sink in plastic laminate tops with epoxy compound to form watertight seal under shelf rim.
      a. In laboratory and pharmacy fit stainless steel sink with overflow standpipe.
      b. Install faucets and fittings on sink ledges with watertight seals where shown.
   2. Install molded resin sinks with epoxy compound to form watertight seal with underside of molded resin top.
      a. Install sink with not less than two channel supports with threaded rods and nuts at each end, expansion bolted to molded resin top.
      b. Design support for a twice the full sink weight.
      c. Install with overflow standpipes.
   3. Install methyl methacrylic polymer sinks in manufacturers recommended adhesive sealer or epoxy compound to underside of methyl methacrylic polymer countertop.
      a. Bolt or screw to countertop to prevent separation of bowl and fracture of adhesive sealant joint.
      b. Install drain and traps to sink.

E. Faucets, Fixtures, and Outlets:
   1. Seal opening between fixture and top.
   2. Secure to top with manufacturers standard fittings.

F. Electrical Outlets:
   1. Set in cutouts with manufacturers gasket sealing joint with top to prevent water leakage.
   2. Install control unit and electric outlets where shown. Seal escutcheon plate at lap if on counter or top to prevent water leakage.

3.2 PROTECTION AND CLEANING

A. Tightly cover and protect against dirt, water, and chemical or mechanical injury.

B. Clean at completion of work.

- - - E N D - - -

SECTION 13 05 41
SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.

B. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:

1. Architectural Elements: glazing; nonbearing partitions; suspended ceilings; cabinets; bookshelves; and storage racks.
2. Electrical Elements: Power and lighting systems; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.
3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; plumbing systems; sprinkler systems.

1.2 RELATED WORK:

A. Section No.092216 NON-STRUCTURAL METAL FRAMING, 095100 ACOUSTICAL CEILINGS, 115313 LABORATORY FUME HOODS, 115353 BIOLOGICAL SAFETY CABINETS, 123100 MANUFACTURED METAL CASEWORK, 123400 MANUFACTURED PLASTIC CASEWORK.

B. Section No. 210511 COMMON WORK RESULTS FOR FIRE SUPRESSION, 211000 WATER-BASED FIRE SUPRESSION SYSTEMS.

C. SECTION NO. 220511 COMMON WORK RESULTS FOR PLUMBING, 221100 FACILITY WATER DISTRIBUTION, 221300 FACILITY SANITARY SEWERAGE, 221400 FACILITY STORM DRAINAGE, 226600 CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES, 226722 PROCESSED WATER SYSTEMS FOR HEALTHCARE FACILITIES.

D. SECTION NO. 230511 COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, 230541 NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, 232113 HYDRONIC PIPING, 232123 HYDRONIC PUMPS, 232213 STEAM AND CONDENSATE HEATING PIPING, 232500 HVAC WATER TREATMENT, 233100 HVAC DUCTS AND CASINGS, 233400 HVAC FANS, 233600 AIR TERMINAL UNITS,237300 INDOOR CENTRAL-STATION AIR HANDLING UNITS, 238200 CONVECTION HEATING AND COOLING UNITS, 238216 AIR COILS.

E. SECTION NO. 260511 REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 260521 LOW VOLTAGE ELECTRICAL POWER CONDUCTOERS AND CABLES (600 VOLTS AND BELOW), 260533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

F. SECTION NO. 270511 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, 270533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS, 271500 COMMUNICATIONS HORIZONTAL CABLING, 275116 PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS - EXTENSION, 275231 SECURITY EMERGENCY CALL, DURESS ALARM AND TELECOMMUNICATIONS - EXTENSION.

G. SECTION NO. 283100 FIRE DETECTION AND ALARM.

1.3 QUALITY CONTROL:

A. Shop-Drawing Preparation:

1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located.
2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.

B. Coordination:

1. Do not install seismic restraints until seismic restraint submittals are approved by the Resident Engineer.
2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

1.4 SUBMITTALS:

A. Submit a coordinated set of equipment anchorage drawings prior to installation including:

1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
3. Numerical value of design seismic brace loads.
4. For expansion bolts, include design load and capacity if different from those specified.

B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:

1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
3. Pipe contents.
4. Structural framing.
5. Location of all gravity load pipe supports and spacing requirements.
6. Numerical value of gravity load reactions.
7. Location of all seismic bracing.
8. Numerical value of applied seismic brace loads.
9. Type of connection (Vertical support, vertical support with seismic brace etc.).
10. Seismic brace reaction type (tension or compression). Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.

C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
   1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
   2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
   3. Maximum spacing of hangers and bracing.
   4. Seal of registered structural engineer responsible for design.

D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.

E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

1.5 APPLICABLE PUBLICATIONS:

A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):
   355.2-07.....Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary

C. American Institute of Steel Construction (AISC):
   Load and Resistance Factor Design, Volume 1, Second Edition.

D. American Society for Testing and Materials (ASTM):

A36/A36M-05.....Standard Specification for Carbon Structural Steel.

A53/A53M-07.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

A307 (REV A-07).....Standard Specification for Carbon Steel Bolts and Studs; 60,000 PSI Tensile Strength.

A325-07.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

A325M-05.....Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric].

A490-06.....Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.

A490M (REV A-04).....Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric].

A500/A500M-07.....Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

A501-07.....Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

A615/A615M-07.....Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

A992/A992M (REV A-06)...Standard Specification for Steel for Structural Shapes for Use in Building Framing.

A996/A996M (REV A-06)...Standard Specification for Rail-Steel and Axel-Steel Deformed Bars for Concrete Reinforcement.

E488-96(R2003).....Standard Test Method for Strength of Anchors in Concrete and Masonry Elements.

E. International Building Code (IBC) 2003 Edition.

F. VA Seismic Design Requirements, H-18-8, December 2003.

G. National Uniform Seismic Installation Guidelines (NUSIG).

H. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
Seismic Restraint Manual - Guidelines for Mechanical Systems, 1998 Edition and Addendum.

1.6 REGULATORY REQUIREMENT:

A. IBC 2003.

B. Exceptions: The seismic restraint of the following items may be omitted:

1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung from a wall.
3. Gas and medical piping less than 2 ½ inches inside diameter.
4. Piping in boiler plants and equipment rooms less than 1 ¼ inches inside diameter.
5. All other piping less than 2 ½ inches inside diameter, except for automatic fire suppression systems.
6. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to the bottom of the support for the hanger.
7. All electrical conduits, less than 2 ½ inches inside diameter.
8. All rectangular air handling ducts less than six square feet in cross sectional area.
9. All round air handling ducts less than 28 inches in diameter.
10. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of support for the hanger.

PART 2 - PRODUCTS

2.1 STEEL:

A. Structural Steel: ASTM A36.

B. Structural Tubing: ASTM A500, Grade B.

C. Structural Tubing: ASTM A501.

D. Steel Pipe: ASTM A53/A53M, Grade B.

E. Bolts & Nuts: ASTM A325.

PART 3 - EXECUTION

3.1 CONSTRUCTION, GENERAL:

A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.

B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.

C. Construct seismic restraints and anchorage to allow for thermal expansion.

D. Testing Before Final Inspection:

1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

3.2 EQUIPMENT RESTRAINT AND BRACING:

A. Refer to drawings for equipment to be restrained or braced.

3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS

A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).
B. Brace duct and breeching branches with a minimum of 1 brace per branch.
D. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.
E. Seismic Restraint of Piping:
   1. Design criteria:
      a. Piping resiliently supported: Restrain to support a minimum of 120 percent of the weight of the systems and components and contents, or as required by Code.
      b. Piping not resiliently supported: Restrain to support a minimum of 60 percent of the weight of the system components and contents, or as required by Code.
F. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

3.4 PARTITIONS

A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.

B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

3.5 CEILINGS AND LIGHTING FIXTURES

A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.

B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 26 51 00, INTERIOR LIGHTING.

3.6 STORAGE RACKS, CABINETS, AND BOOKCASES

A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.

B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.

C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.

D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

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SECTION 21 05 11
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 21.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.
2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 07 84 00, FIRESTOPPING.

D. Flashing for Wall and Roof Penetrations: Section 07 60 00, FLASHING AND SHEET METAL.

E. Section 07 92 00, JOINT SEALANTS.

F. Section 09 91 00, PAINTING.

G. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

H. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

1.3 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
2. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
3. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
4. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
5. Asbestos products or equipment or materials containing asbestos shall not be used.

B. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

C. Guaranty: Section 00 72 00, GENERAL CONDITIONS.

D. Extended Guarantee Period Services:

1. Qualifications: All service technicians assigned to perform work under this contract shall be qualified and factory trained by the Original Equipment Manufacturer (O.E.M.). Each technician shall have at least three years experience of working on comparable systems and shall be a full time employee of the contractor. The contractor shall furnish, for the Department of Veterans Affairs (VA) review and approval, resumes of all service technicians scheduled to service the equipment and systems. The resume shall include details of experience, training, and educational qualifications and performance evaluations.
2. Replacement Parts: The contractor shall be equipped with all replacement parts of all equipment and systems to be serviced and the manufacturer's standard service and repair procedures. All replacement parts shall be brand new and of current design. The replacement parts shall be O.E.M. items. Obsolete or refurbished parts are unacceptable. "Approved Equal" parts must have prior approval of the Contracting Officer. Contractor shall furnish evidence of guaranteed supply of parts for the life of the system.
3. Service Supplies: The services shall include, without any additional cost to the government, all replacement parts, special tools and equipment, and consumable materials, that is, lubrication oil, grease, and cleaning materials, as required. The requirement of UL listing, where applicable, shall not be voided by any replacement parts, components, software, or modifications provided by the contractor.
4. Scheduled and Emergency Call Service: The service shall include a scheduled monthly visit to perform systematic examination of equipment and/or systems and a 7 day, 24 hours call back service for emergency service. The emergency service is defined as a situation created by a breakdown or malfunction of any equipment or system warranting urgent attention. A qualified service representative shall

respond to the VA request for emergency service within two hours and assess the problem either by telephone or remote diagnostic capability. If the emergency situation cannot be rectified by the VA personnel, on site emergency service shall be provided by sending a qualified service representative within 24 hours. For the rural locations of the VA medical centers, situated over 200 miles from the contractor's established service depot, the maximum response time of 48 hours shall be acceptable. The emergency service shall be limited to adjustments and repairs specifically required to protect the safety of the equipment for which the emergency service was required to be performed.

5. Licensing: The contractor shall be licensed to perform the contracted services. The contractor shall furnish details of all applicable local and state licensing requirements to VA as a part of the qualification requirements. The licenses shall be current, valid through the term of the contract and in the name of the contractor.
6. Documentation Requirements: The contractor shall maintain a separate log for each item of equipment and each system covered under the extended guarantee period service contract with the VA Medical Center (VAMC) Engineering Service. The log shall list dates and times of all scheduled and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency, steps taken to rectify the situations, and specific recommendations to avoid such conditions in the future.
7. Reports: The contractor shall provide a quarterly report for the first year and twice a year for the remainder of the guarantee period for all equipment and systems serviced under the extended guarantee period contract. The report shall clearly and concisely describe the services rendered, parts replaced, and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
8. Quality Program: The contractor shall provide a description of the quality management and control program. The description shall include a tangible proof the existence of such program, names of at least three customers who have participated in the program, and specific information showing the applicability of program to the project.
9. Training: During each scheduled service visit, the contractor shall actively involve the VAMC maintenance personnel in performing scheduled service and associated activities. The practical training during the scheduled service visits shall include parting oral and

written instructions, for each specific task of the servicing contract, to the VAMC maintenance personnel who shall operate the hardware and software in accordance with the intent of the design and under direct supervision of the service contractor's qualified service technician. At the end of the first year of the service contract, the contractor shall obtain a certificate from the VAMC Engineering Service confirming completion of training to the authorized VA representatives.

10. Classroom Training: Provide list and costs of available classroom training courses offered by contractor or O.E.M.

E. Supports for sprinkler piping shall be in conformance with NFPA 13.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
   1. Equipment and materials identification.
   2. Fire-stopping materials.
   3. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
   4. Wall, floor, and ceiling plates.

C. Coordination Drawings: In accordance with Section 00 72 00, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION. Provide detailed layout drawings of all piping systems. In addition provide details of the following.
   1. Mechanical equipment rooms.
   2. Interstitial space.
   3. Hangers, inserts, supports, and bracing.
   4. Pipe sleeves.
   5. Equipment penetrations of floors, walls, ceilings, or roofs.

D. Maintenance Data and Operating Instructions:
   1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
   2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):
A36/A36M-2001.....Carbon Structural Steel
A575-96.....Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)
E84-2003.....Standard Test Method for Burning Characteristics of Building Materials
E119-2000.....Standard Test Method for Fire Tests of Building Construction and Materials

C. National Fire Protection Association (NFPA):
90A-96.....Installation of Air Conditioning and Ventilating Systems
101-97.....Life Safety Code

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

C. Valve Tags and Lists:
1. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm(1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
2. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
3. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.2 FIRESTOPPING

Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

2.3 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

2.4 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.

B. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirement must receive prior approval of Resident Engineer.

D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.

G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to

accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.5 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate location of piping, sleeves, inserts, hangers, and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly exposed materials and equipment.

C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

D. Install gages, valves, and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

E. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Resident Engineer for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

F. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.

G. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.

H. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling

under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 INSTRUCTIONS TO VA PERSONNEL

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 21 10 00
WATER-BASED FIRE-SUPPRESION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Modification of the existing sprinkler system as indicated on the drawings. Size system in accordance with NFPA 13 latest editions.

B. Existing piping to be reused, replaced or removed as indicated on the drawings. Removal of piping to include all valves, flow switches, supervisory devices, hangers, supports, and associated fire alarm system conduit and wire.

C. Provide access doors or panels where control or drain valves are located behind plaster or gypsum walls or ceilings as necessary to install piping above suspended plaster or gypsum ceilings.

D. Painting of exposed piping and supports to follow Section 09 91 00, PAINTING.

1.2 RELATED WORK

A. Treatment of penetrations through rated enclosures: Section 07 84 00, FIRESTOPPING.

B. Access panels for plaster ceilings: Section 08 31 13, ACCESS DOORS AND FRAMES.

C. Painting of exposed pipe: Section 09 91 00, PAINTING.

D. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION.

E. Alarm Supervision: Section 28 31 00, FIRE DETECTION AND ALARM.

F. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 DESIGN CRITERIA

A. The design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system shall be in accordance with the required advisory provisions of NFPA 13.

B. Base system design hydraulic calculations using the area/density method on the following criteria and in accordance with NFPA 13 latest edition.

1. Sprinkler Protection:

a. All patient care, sleeping, treatment, office, waiting areas, educational areas, dining areas, corridors and attics: Light hazard, (0.10 gpm/sq. ft.) over the hydraulically most remote 140 m^2 (1500 sq. ft.).

b. Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Shafts (if required), Elevator Machine Rooms, Refrigeration Service Rooms, and storage between 9 and 23 m^2 (100 and 250 sq. ft.): Ordinary Hazard,

Group 1, 6.1 L/minute/m² (0.15 gpm/sq. ft.) over the hydraulically most remote 140 m² (1500 sq. ft.).

c. Clean and soiled linen rooms, trash rooms, clean and soiled utility rooms, laundry, laboratories, retail sales and storage rooms, storage room over 23 m² (250 sq. ft.), boiler plants, loading docks, warehouse spaces, energy centers, Pharmacy and SPD areas: Ordinary Group 2, 8.1 L/minute/m² (0.20 gpm/sq. ft.) over the hydraulically most remote 140 m² (1500 sq. ft.).

d. File Storage Areas with “Rolling Files” Racks: Ordinary Group 2 for the entire area of the space up to 140 m² (1500 sq. ft.) area of sprinkler operation.

e. Supply warehouse with storage height less than 3650 mm (12 ft. high): Ordinary Hazard Group 2. Storage height exceeding 3650 mm (12 ft.), per NFPA 13 latest edition.

f. Provide sprinklers in accessible shafts per NFPA 13 latest edition.

g. Provide sprinklers in gravity type metal chutes per NFPA 82.

2. Add water allowance of 15 L/s (250 gpm) for inside and outside hose streams to the sprinkler requirements at the connection to the distribution main.

3. Hydraulic Calculations: The calculated demand including hose stream requirements shall fall no less than 10 percent below the available supply curve.

4. Water Supply:

a. Contractor is required to perform a fire-water flow test to obtain the sprinkler system static pressure, residual pressure and flow rate of existing system.

C. Provide a guard for each sprinkler in the janitors closets, the elevator machine room and sprinklers within 2100 mm (7 ft.) of the floor and other areas as required by NFPA 13.

D. Locate sprinklers in patient bedrooms assuming all privacy curtains have 13 mm (1/2 in.) openings in mesh extending 450 mm (18 in.) from ceiling.

E. Seismic Protection: Seismically brace all new piping systems in accordance NFPA 13 latest edition.

1.4 QUALIFICATIONS:

A. Designer's Qualifications: Design work and shop drawings shall be prepared by a licensed engineer practicing in the field of Fire Protection Engineering or a NICET (National Institute for Certification in Engineering Technologies) Level III sprinkler technician.

B. Installer's Qualifications: The installer shall possess a valid State fire protection contractor’s license. The installer shall provide documentation of having successfully completed three projects of similar size and scope.

C. On-site emergency service within six hours notification.

1.5 SUBMITTALS

A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sprinkler design shall be preformed by professional’s Registration or Certification. All plans shall be stamped by qualified P.E.

C. Emergency service point of contact name and 24 hour emergency telephone number.

D. Manufacturer’s Literature and Data:

1. Pipe and fittings.
2. Valves
3. Drips
4. Sprinklers-each type, temperature and model
5. Inspectors Test Alarm Modules
6. Sprinkler Cabinets
7. Sprinkler Plugs
8. Pipe Hangers and Supports
9. Water Flow Switches
10. Valve Tamper Switches

E. Detailed drawings in accordance with NFPA 13 the latest editions. Drawings shall be prepared using CADD software stamped by fire protection professional engineer and include all new and existing sprinklers and piping. Use format in use at the VA medical center. Drawings are subject to change during the bidding and construction periods. Any wall and ceiling changes occurring prior to the submittal of contractors shop drawings shall be incorporated into the contractors detailed design at no additional contract cost.

F. Hydraulic calculations for each sprinkler system in accordance with NFPA 13 latest edition.

G. Recommended preventive maintenance schedule.

1.6 AS-BUILT DOCUMENTATION

A. A mylar as-built drawing and two blueline copies shall be provided for each drawing. One copy of final CADD drawing files shall also be provided on a compact disk for all the shop drawings.

B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

C. Four sets of hydraulic calculations for each sprinkler system updated to include submittal review comments and any changes to the installation which affect the calculations including one electronic set in PDF format.

D. Four copies of the hydrostatic report and NFPA 13 material and test certificate for each sprinkler system.

E. Four sets of operation and maintenance data updated to include submittal review comments and any equipment substitutions including one copy of NFPA 25.

F. Manufacturers literature, hydraulic calculations, reports and operation and maintenance data shall be in a labeled 3-ring binder.

1.7 WARRANTY

A. All work performed and materials and equipment furnished under this contract shall be free from defects for a period of one year from date of acceptance by the government.

B. All new piping and equipment incorporated into the new system shall be hydrostatically tested and warranted as new.

1.8 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. National Fire Protection Association (NFPA)

13-2002.....Installation of Sprinkler Systems
25-2004.....Inspection, Testing and Maintenance of water Based Fire Protection Systems
70-2004.....National Electrical Code
72-2002.....National Fire Alarm Code
170-2005.....Standards for Fire Safety Symbols
291-2002.....Fire Flow Testing and Marking of Hydrants

C. Underwriters Laboratories Inc. (UL)

2006.....Fire Protection Equipment Directory

D. Factory Mutual Engineering Corporation (FM)

2006.....Approval Guide

E. American Society for Testing and Materials (ASTM)

F442-99(2005).....Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe

F. American Society of Sanitary Engineering (ASSE)
1015-2005.....Double Check Backflow Prevention Assembly

G. Complete maintenance and inspection service for the fire pump and sprinkler systems shall be provided by a factory trained authorized representative of the manufacturer of the major equipment for a period of one year after acceptance of the entire installation by the government.

H. Contractor shall provide all necessary test equipment, parts and labor to perform required maintenance.

I. All inspections, testing and maintenance work required by NFPA 25, NFPA 20, NFPA 13 and recommended by the equipment manufacturer shall be provided. Work shall include operation of sprinkler system alarm and supervisory devices.

J. Maintenance and testing shall be performed on a quarterly basis. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment, and cleaning of all equipment.

K. Non-included Work: Maintenance service shall not include the performance of any work due to improper use, accidents or negligence for what the contractor is not responsible.

L. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of work performed and parts replaced shall be provided.

M. Emergency Service:
   1. Normal and overtime emergency call-back service shall consist of an on-site response to calls within four hours of notification.
   2. Overtime emergency call-back service shall be limited to minor adjustments and repairs to effect the integrity of the system.
   3. All but a single sprinkler system must be operational before the responding service person leaves the facility.

PART 2 - PRODUCTS

2.1 GENERAL

All devices and equipment shall be Underwriters Laboratories Inc. listed for their intended purpose. All sprinklers shall be Factory Mutual approved.

2.2 PIPING AND FITTINGS

A. Pipe and fittings from inside face of building 300 mm (12 in.) above finished floor to a distance of approximately 1500 mm (5 ft.) outside building: Ductile Iron, flanged fittings and 316 stainless steel bolting.

B. Fire Protection water supply within the building up to sprinkler system isolation valves shall be black steel, schedule 10 minimum.

C. Sprinkler piping downstream of the isolation valve on wet-pipe systems shall be black steel, schedule 10 minimum for 2-1/2″ and larger piping, black steel schedule 40 minimum for 2″ and smaller piping.

D. Threaded or flanged fittings shall be ANSIB1 6.3 cast iron, class 125 minimum. Threaded fittings are not permitted on pipe with wall thickness less than schedule 40.

E. All fittings on galvanized piping shall be galvanized in accordance with ASTM A53.

F. Slip type or clamp-on type rubber gasketed fittings shall be listed for each piping application.

G. Piping Materials Standards:
   1. Ferrous piping – follow ASTM A 795 Standard
   2. Welded and seamless steel pipe – follow ANSI/ASTM A 53
   3. Wrought steel pipe – follow ANSI/ASME B36.10M
   4. Electric resistance welded steel pipe – follow ASTM A 135

H. Fitting Materials Standards:
   1. Cast iron threaded fitting, Class 125 and 250 - follow ASME B16.4
   2. Cast iron pipe flanges and flanged fittings - follow ASME B16.1
   3. Malleable iron threaded fittings, Class 150 and 300 steel - follow ASME B16.3
   4. Factory made wrought steel buttweld fittings - follow ASME B16.9
   5. Buttwelding ends for pipe, valves, flanges, and fitting - follow ASME B16.25

I. Pipe Identification – All pipe, including specially listed pipe allowed by NFPA 13, shall be marked continuously along its length by the manufacturer in such a way as to properly identify the type of pipe. Pipe identification shall include the manufacturer’s name, model designation, or schedule.

2.3 VALVES

A. Listed Indicating Valves:
   1. Gate: OS&Y, 1200 kPa (175 lb.) WOG or equal.

2. Butterfly: Gear operated, indicating type, 1200 kPa (175 lb.) WOG or equal. Butterfly valves are to be installed in a manner that does not interfere with the operation of any system component.
3. Ball (inspectors test and drain only): iron body, stainless steel trim, for 2050 kPa (300 psi) service, indicating type.
4. Ball and butterfly valves shall not be used on incoming water service, and on the suction side of either the fire pump or jockey pump.

B. Check Valves: Swing type, rubber faced or wafer type spring loaded butterfly check valve, 1200 kPa (175 lb.) WOG or equal.

C. Drain Valves: Threaded bronze angle, globe, ball or butterfly, 1000 kPa (150 lb.) WOG or equal equipped with reducer and hose connection with cap or connected to a drain line.

D. Self-contained Test and Drain Valve:
1. Ductile iron body with bronze “Drain” and “Test” bonnets. Acrylic sight glass for viewing test flow. Various sized orifice inserts to simulate flow through 14 mm (17/32 in.), 13 mm (1/2 in.), 12 mm (7/16 in.), and 10 mm (3/8 in.) diameter sprinklers, 32 mm (1 1/4 in.) female threaded outlets or 32 mm (1 1/4 in.) one-quarter turn locking lug outlets for plain end pipe (end preparation to be in accordance with manufacturer’s recommendation).
2. Bronze body, with chrome plated bronze ball, brass stem, steel handle, teflon seat and sight glasses. Provide valve with three position indicator plate (off, test, and drain), 6 mm (1/4 in.) tapping for pressure gage and various other orifice inserts to simulate flow through 10 mm (3/8 in.), 12 mm (7/16 in.), 13 mm (1/2 in.), and 14 mm (17/32 in.) diameter sprinklers.

2.4 AUTOMATIC BALL DRIPS

Cast brass 20 mm (3/4 in.) in line automatic ball drip with both ends threaded with iron pipe threads.

2.5 SPRINKLERS

A. Quick response sprinklers shall be standard type except as noted below. The maximum distance from the deflector to finished ceiling shall be 50 mm (2 in.) for pendent sprinklers. Pendent sprinklers in finished areas shall be provided with semi-recessed adjustable screwed escutcheons and installed within the center one-third of their adjustment. The sprinkler shall be installed in the flush position with the element exposed below the ceiling line. At the specified locations, provide the following type of sprinklers. All sprinklers except

"institutional" type sprinklers shall be FM approved. Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval, and the following:

LOCATION	TYPE
Mechanical Equipment Rooms, Electrical & Electrical Switch Gear Rooms	Quick Response, Upright or Telephone Closets, Transformer Vaults Pendent Brass [93 °C (200 °F)]
Elevator Shafts, Dumbwaiter Shafts, Elevator Machine Rooms, Elevator Pits	Standard Upright or Sidewall Brass [93 °C (200 °F)]
Gravity Type Linen & Trash Chutes	Standard Upright or Pendent Brass [66-74 °C (150-165 °F)]
Warehouse [Storage under 3600 mm (12 ft.)]	Quick Response, Pendent or Upright, Brass [77-74 °C (150-165 °F)]
Warehouse [Storage over 3600 mm (12 ft.)]	See NFPA 13
Cold rooms, Freezers, Controlled Temperature Rooms and Unheated Areas	Standard Pendent, Dry Type [66-74 °C (150-165 °F)]
Kitchen Hoods, Exhaust Ducts & Duct Collars	Standard Pendent or Upright (Extra High Temperature [163-191 °C (325-375 °F.)]
Generator Rooms	Standard Pendent or Upright [141 °C (286 °F)]
Mental Health and Behavioral Unit: Nursing Bedroom, Toilets and all areas with plaster/ dry wall ceilings within the area	Institutional Quick Response; Chrome plated with 85 lb. breakaway, Pendent, Horizontal Sidewall [66-74 °C (150-165 °F)]
Patient Sleeping, Patient Bathrooms, and Corridors within a Patient Ward	Residential, Quick Response, Recessed Pendent, Chrome Plated, [66-74 °C (150-165 °F)]
All Patient Treatment, Elevator Lobbies and Corridors	Quick Response, Recessed Pendent, Chrome Plated [66-74 °C [150-165 °F)]
Operating Rooms, Radiology Rooms, Nuclear Medicine Rooms	Quick Response, Recessed Pendent, Chrome Plated, Sidewall [66-74 °C (150-165 °F)]
All Areas Not Listed Above	Quick Response, Recessed Pendent, Sidewall, Chrome Plated [66-74 °C (150-165 °F)]

B. Do not use quick response sprinklers in the same sprinkler zone with other sprinklers types. In sprinklered light hazard patient zones that

are expanded into fully sprinklered zones, revise the existing system to contain quick response sprinklers.

C. Sprinklers to be installed as per NFPA 13.

2.6 TOOLS AND REPLACEMENT PARTS

A. Sprinkler Cabinet:
   1. Provide a minimum 5 percent spare sprinklers with escutcheons with a minimum of two of each type/or as required by NFPA-13, whichever is more demanding.
   2. Provide a minimum of two of each type sprinkler wrenches used.
   3. Install cabinets in each building where directed by the Resident Engineer.
   4. Spare sprinklers shall be kept in a cabinet where ambient temperatures do not exceed 100 Deg F.

2.7 IDENTIFICATION SIGNS

Provide for all new and existing sectional valves, riser control valves, system control valves, drain valves, test and drain connections and alarm devices with securely attached identification signs (enamel on metal) in accordance with NFPA 13.

2.8 STANDPIPE HOSE VALVE CABINETS

White glossy polyester coated 20 gage steel box, 20 gage tubular steel door and 18 gage frame with continuous steel hinge with brass pin, welded and ground smooth steel corner seams, recess type, 600 x 600 x 250 mm (24 x 24 x 10 in.). Finish door and frame with white prime polyester coating.

2.9 HANGERS AND EARTHQUAKE BRACING

In accordance with NFPA 13. Comply with seismic requirements as per 15050 for seismic zone locations.

2.10 WALL, FLOOR AND CEILING PLATES

A. Exposed piping passing through walls, floors or ceilings shall be provided with chrome colored escutcheon plates.

B. Comply with NFPA 101 Fire Barrier Penetration codes.

2.11 HANGERS

A. Hangers shall be designed to support five times the weight of the water filled pipe pluse 250 Lb (114Kg) at each point of piping support.

B. These points of support shall be adequate to support the system.

C. The spacing between hangers shall not exceed the value given for the type of pipe as indicated in NFPA 13 tables.

D. Hanger components shall be ferrous.

E. Detailed calculations shall be submitted, when required by the reviewing

Authority, showing stress developed in hangers, piping, fittings and safety factors allowed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Drains, Test Pipes and Accessories:
   1. Provide a drain at other locations for complete drainage of the system. Provide valve in drain lines and connect to the central drain riser. Discharge riser outside over splash block, indirectly over standpipe drain connected to storm sewer, or as indicated. The main drain shall be capable of full discharge test without allowing water to flow onto the floor.
   2. Provide test pipes in accordance with NFPA 13. Test pipes shall be valved and piped to discharge through proper orifice as specified above for drains.

B. Conceal all piping, except in pipe basements, stairwells and rooms without ceilings.

C. Install new piping and sprinklers aligned with natural building and other sprinklers lines.

D. Locate piping with a minimum headroom of 2250 mm (7 ft.-6 in.) for all piping.

E. Piping arrangement shall avoid contact with other piping and equipment and allow clear access to other equipment or devices requiring access or maintenance.

F. Cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections, shall be affixed near to the pipe where the originated. They shall be displayed until final inspection and then removed.

G. Firestopping shall comply with Section 07 84 00, FIRESTOPPING. All holes through stairways, smoke barrier walls, and fire walls shall be sealed on a daily basis.

H. Provide hydraulic design information signage as required by NFPA 13 and 14.

I. Install access doors in ceilings of rooms where above ceiling access is required.

3.2 TEST

A. Automatic Sprinkler System: NFPA 13 and 25.

3.3 INSTRUCTIONS

Furnish the services of a competent instructor for not less than two four-hour periods for instructing personnel in the operation and

maintenance of the fire pump and sprinkler system, on the dates requested by the COTR.

- - - END - - -

SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 22.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.
2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 02 82 14, ASBESTOS HAZARD CONTROL ACTIVITIES.

E. Section 07 84 00, FIRESTOPPING.

F. Section 07 92 00, JOINT SEALANTS.

G. Section 09 91 00, PAINTING.

H. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

I. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

J. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

K. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions.
2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 100 miles of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service organizations providing

service under these conditions for (as applicable to the project): pumps, critical instrumentation, computer workstation and programming.

3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent then those specified. Refer any conflicts to the Resident Engineer (RE)/Contracting Officers Technical Representative (COTR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Asbestos products or equipment or materials containing asbestos shall not be used.

B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

D. Execution (Installation, Construction) Quality:
   1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the RE/COTR for resolution. Provide written hard copies or computer files of manufacturer’s installation instructions to the RE/COTR at least two weeks prior to commencing installation of any item.
   2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this requirement and contract drawings to the RE/COTR for resolution.
   3. Provide complete layout drawings required by Paragraph, SUBMITTALS. Do not commence construction work on any system until the layout drawings have been approved.

E. Guaranty: Section 00 72 00, GENERAL CONDITIONS.

F. Extended Guarantee Period Services:
   1. Qualifications: All service technicians assigned to perform work under this contract shall be qualified and factory trained by the Original Equipment Manufacturer (O.E.M.). Each technician shall have at least three years experience of working on comparable systems and shall be a full time employee of the contractor. The contractor shall furnish, for the Department of Veterans Affairs (VA) review and approval, resumes of all service technicians scheduled to service the equipment and systems. The resume shall include details of experience, training, and educational qualifications and performance evaluations.
   2. Replacement Parts: The contractor shall be equipped with all replacement parts of all equipment and systems to be serviced and the manufacturer's standard service and repair procedures. All replacement parts shall be brand new and of current design. The replacement parts shall be O.E.M. items. Obsolete or refurbished parts are unacceptable. "Approved Equal" parts must have prior approval of the Contracting Officer. Contractor shall furnish evidence of guaranteed supply of parts for the life of the system.
   3. Service Supplies: The services shall include, without any additional cost to the government, all replacement parts, special tools and

equipment, and consumable materials, that is, lubrication oil, grease, and cleaning materials, as required. The requirement of UL listing, where applicable, shall not be voided by any replacement parts, components, software, or modifications provided by the contractor.

4. Scheduled and Emergency Call Service: The service shall include a scheduled monthly visit to perform systematic examination of equipment and/or systems and a 7 day, 24 hours call back service for emergency service. The emergency service is defined as a situation created by a breakdown or malfunction of any equipment or system warranting urgent attention. A qualified service representative shall respond to the VA request for emergency service within two hours and assess the problem either by telephone or remote diagnostic capability. If the emergency situation cannot be rectified by the VA personnel, on site emergency service shall be provided by sending a qualified service representative within 24 hours. For the rural locations of the VA medical centers, situated over 200 miles from the contractor's established service depot, the maximum response time of 48 hours shall be acceptable. The emergency service shall be limited to adjustments and repairs specifically required to protect the safety of the equipment for which the emergency service was required to be performed.
5. Licensing: The contractor shall be licensed to perform the contracted services. The contractor shall furnish details of all applicable local and state licensing requirements to VA as a part of the qualification requirements. The licenses shall be current, valid through the term of the contract and in the name of the contractor.
6. Documentation Requirements: The contractor shall maintain a separate log for each item of equipment and each system covered under the extended guarantee period service contract with the VA Medical Center (VAMC) Engineering Service. The log shall list dates and times of all scheduled and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency, steps taken to rectify the situations, and specific recommendations to avoid such conditions in the future.
7. Reports: The contractor shall provide a quarterly report for the first year and twice a year for the remainder of the guarantee period for all equipment and systems serviced under the extended guarantee period contract. The report shall clearly and concisely describe the services rendered, parts replaced, and repairs performed. The report

shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.

8. Quality Program: The contractor shall provide a description of the quality management and control program. The description shall include a tangible proof the existence of such program, names of at least three customers who have participated in the program, and specific information showing the applicability of program to the project.
9. Training: During each scheduled service visit, the contractor shall actively involve the VAMC maintenance personnel in performing scheduled service and associated activities. The practical training during the scheduled service visits shall include parting oral and written instructions, for each specific task of the servicing contract, to the VAMC maintenance personnel who shall operate the hardware and software in accordance with the intent of the design and under direct supervision of the service contractor's qualified service technician. At the end of the first year of the service contract, the contractor shall obtain a certificate from the VAMC Engineering Service confirming completion of training to the authorized VA representatives.

G. Plumbing Systems: NAPHCC National Standard Plumbing Code.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 11, COMNON WORK RESULTS FOR PLUMBING", with applicable "Group" number.

C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

F. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

G. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
   1. Submit electric motor data and variable speed drive data with the driven equipment.
   2. Equipment and materials identification.
   3. Fire-stopping materials.
   4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
   5. Wall, floor, and ceiling plates.

H. Coordination Drawings: In accordance with Section 00 72 00, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION. Submit complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show the proposed location and adequate clearance for all equipment, piping, pumps, valves and other items. Show the access means for all items requiring access for operations and maintenance. Do not install equipment foundations, equipment or piping until layout drawings have been approved. Provide detailed layout drawings of all piping systems. In addition provide details of the following.
   1. Mechanical equipment rooms.
   2. Interstitial space.
   3. Hangers, inserts, supports, and bracing.
   4. Pipe sleeves.
   5. Equipment penetrations of floors, walls, ceilings, or roofs.

I. Maintenance Data and Operating Instructions:
   1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
   2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
   1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
   2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the RE/COTR. Such repair or replacement shall be at no additional cost to the Government.
   3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
   4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:
   1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
   2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
   3. Clean interior of all tanks prior to delivery for beneficial use by the Government.
   4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):
   Boiler and Pressure Vessel Code (BPVC):
   SEC IX-98.....Qualifications Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators

C. American Society for Testing and Materials (ASTM):
   A36/A36M-2001.....Carbon Structural Steel
   A575-96.....Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)

E84-2003.....Standard Test Method for Burning Characteristics of Building Materials

E119-2000.....Standard Test Method for Fire Tests of Building Construction and Materials

D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:

SP-58-93.....Pipe Hangers and Supports-Materials, Design and Manufacture

SP 69-2003.....Pipe Hangers and Supports-Selection and Application

E. National Electrical Manufacturers Association (NEMA):

MG1-2003, Rev. 1-2004...Motors and Generators

F. National Association of Plumbing - Heating - Cooling Contractors (NAPHCC):

1996.....National Standard Plumbing Code

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 SAFETY GUARDS

Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

2.4 LIFTING ATTACHMENTS

Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.5 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished and installation methods shall conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT; Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS; and, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.

b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.

c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

5. Motors utilized with variable frequency drives shall be rated “inverter-ready” per NEMA Standard, MG1, Part 31.4.4.2.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency” by the project specifications on driven equipment. Motor manufacturers generally define these efficiency requirements as “NEMA premium efficient” and the requirements generally exceed those of the Energy Policy Act of 1992 (EPACT). Motors not specified as “high efficiency” shall comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

F. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 40 degrees centigrade (104 degrees F); minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.6 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

C. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

D. Valve Tags and Lists:

1. Plumbing: Provide for all valves (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm(1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Typed or printed plastic coated card(s), sized 216 mm(8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.7 FIRESTOPPING

Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for firestop pipe insulation.

2.8 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

2.9 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the National Uniform Seismic Installation Guidelines (NUSIG), most current edition. Submittals based on either the NUSIG guidelines or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. Support of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the Resident Engineer in all cases. See paragraph 2.8.M for lateral force design requirements.

B. Type Numbers Specified: MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

C. For Attachment to Concrete Construction:

1. Concrete insert: Type 18, MSS SP-58.

2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.
3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.

D. For Attachment to Steel Construction: MSS SP-58.
1. Welded attachment: Type 22.
2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.

E. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

F. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41mm by 41mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.
1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

G. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
1. General Types (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15. preinsulate

g. U-bolt clamp: Type 24.

h. Copper Tube:

1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.

2) For vertical runs use epoxy painted or plastic coated riser clamps.

3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.

4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp. Spring Supports (Expansion and contraction of vertical piping):

1) Movement up to 20 mm (3/4-inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.

2) Movement more than 20 mm (3/4-inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.

2. Plumbing Piping (Other Than General Types):

a. Horizontal piping: Type 1, 5, 7, 9, and 10.

b. Chrome plated piping: Chrome plated supports.

c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.

d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.

H. Pre-insulated Calcium Silicate Shields:

1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.

2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.

3. Shield thickness shall match the pipe insulation.

4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.

a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

I. Seismic Restraint of Piping: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

2.10 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
B. To prevent accidental liquid spills from passing to a lower level, provide the following:
1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Resident Engineer.
D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms

above basement. Except in mechanical rooms, connect sleeve with floor plate.

G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.11 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.12 ASBESTOS

Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Coordinate location of piping, sleeves, inserts, hangers, and equipment, access provisions, and work of all trades.. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Submit the drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:

1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by RE/COTR where working area space is limited.
2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by RE/COTR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to RE/COTR for approval.
3. Do not penetrate membrane waterproofing.

F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

H. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment

against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

J. Electrical and Pneumatic Interconnection of Controls and Instruments: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.

K. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Resident Engineer for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

L. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.

M. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.

N. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance,

equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.

2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Para. 3.1 apply.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.3 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.

E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Rigging plan and methods shall be referred to RE/COTR for evaluation prior to actual work.

3.4 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Resident Engineer.

B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.

D. Plumbing horizontal and vertical pipe supports, refer to the NAPHCC National Standard Plumbing Code.

E. Overhead Supports:

1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems shall be supported in channel troughs.

F. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Anchor and dowel concrete bases and structural systems to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Do not locate or install bases and supports until equipment mounted thereon has been approved. Size bases to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges.Refer to structural drawings. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.

4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LUBRICATION

A. Lubricate all devices requiring lubrication prior to initial operation. Field-check all devices for proper lubrication.

3.6 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor after approval for structural integrity by the RE/COTR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating plant, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of plant operation. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VA Medical Center, and Contractor shall follow all directives of the RE or COTR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government

property and shall be removed and delivered to RE/COTR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

E. Asbestos Insulation Removal: Conform to Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. Material And Equipment Not To Be Painted Includes:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gauges and thermometers.
   j. Glass.
   k. Name plates.
3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.

6. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.8 IDENTIFICATION SIGNS

A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.9 STARTUP AND TEMPORARY OPERATION

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.10 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.11 OPERATION AND MAINTENANCE MANUALS

A. Provide four bound copies. Deliver to RE/COTR not less than 30 days prior to completion of a phase or final inspection.

B. Include all new and temporary equipment and all elements of each assembly.

C. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, other data.

D. Manufacturer’s installation, maintenance, repair, and operation instructions for each device. Include assembly drawings and parts lists. Include operating precautions and reasons for precautions.

E. Lubrication instructions including type and quantity of lubricant.

F. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications.

G. Set points of all interlock devices.

H. Trouble-shooting guide for control systems.

I. Operation of the combustion control system.

J. Emergency procedures.

3.12 INSTRUCTIONS TO VA PERSONNEL

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

- - - E N D - - -

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. General-duty valves for domestic water and sewer systems.

1.2 RELATED WORK

A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Valves.
2. Backflow Preventers.
3. Pressure Reducing Valves.
4. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):
A536-84(R1999) E1.....Ductile Iron Castings

C. National Association of Plumbing - Heating - Cooling Contractors (PHCC):
National Standard Plumbing Code - 1996

D. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
SP-67-02.....Butterfly Valve of the Single flange Type (Lug Wafer)
SP-70-98.....Cast Iron Gate Valves, Flanged and Threaded Ends.
SP-72-99.....Ball Valves With Flanged or Butt Welding For General Purpose
SP-80-03.....Bronze Gate, Globe, Angle and Check Valves.
SP-110-96.....Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

E. American Society of Sanitary Engineers (ASSE):
1013-99.....Reduced Pressure Principle Backflow Preventers

1015-99.....Double Check Backflow Prevention Assembly

PART 2 - PRODUCTS

2.1 VALVES

A. Asbestos packing is prohibited.

B. Shut-off:

1. Cold, Hot and Recirculating Hot Water:

a. Fifty millimeter (2 inches) and smaller:

1) Ball, Mss SP-72, SP-110, Type II, Class 125, Style 1, three piece or double union end construction, full ported, full flow, with solder end connections, 2750 kPa (400 psi) WOG, MSS-SP-67.

b. Less than 100 mm (4 inches): Butterfly, iron body, aluminum bronze disc, 416 stainless steel stem, EPDM seat, wafer design, lever operator to six 150 mm (6 inch)size, , 1375 kPa (200 pound) WOG, Fed. Spec WW-V-1967.

c. One hundred millimeters (4 inches) and larger:

1) Gate, MSS-SP-70, wedge disc, class 125, cast iron body with bronze trim, flanged, gear operated and crank for 200 mm (8 inches) and above.

2) Grooved end butterfly valves with ductile iron body and disc core ASTM A536. Disc rubber coated with compatible material for intended service, maximum working pressure 2050 kPa (300 pounds psi) grooved ends for connection with mechanical grooved couplings.

2. Reagent Grade Water: Shall be ball type of same material as used for pipe.

C. Balancing:

1. Hot Water Recirculating, 50 mm (2 inches) and smaller: Combination type, calibrated, bronze with bronze disc, equipped with readout valves with integral check valve, indexing position pointer and calibrated name plate, internal EPT 0-ring seals and factory molded insulating enclosures.

2. Larger than 50 mm (2 inches): Combination balancing and shut-off, non-lubricated eccentric plug type with cast iron or semi-steel body, electroless nickel plated cast iron plug, with resilient facing suitable for continuous water service up to 80 °C (180 °F),

bronze bearings, 1200 kPa (175 pound) WOG rating and an adjustable open position memory stop and lever.

D. Check:

1. Less than 100 mm (3 inches) and smaller): Bronze body and trim, swing type, MSS-SP-80, 850 kPa (125 pound) WSP.
2. Larger than 100 mm (4 inches and larger):
   a. Iron body, bronze trim, swing type, vertical or horizontal installation, flange connections, 1375 kPa (200 pound) WOG.
   b. Ductile iron (ASTM A536) or malleable iron (ASTM A47) body, stainless steel or aluminum bronze trim, dual disc, spring loaded, non-slamming design with grooved ends for connection with mechanical grooved couplings. Consult manufacturer for appropriate elastomeric seal for intended service. Maximum working pressure 3450 kPa (500 pounds psi), depending on size.

E. Globe:

1. Eighty millimeters (3 inches) or smaller: Bronze body and bonnet, MSS-SP-80, 850 kPa (125 pound) WSP. Disk shall be free to swivel on the stem. Composition seating surface disk construction may be substituted for all metal disk construction. Packing shall be a woven non-asbestos material, impregnated with not less than 25 percent, by weight, tetrafluoroethylene resin.
2. Larger than 80 mm (3 inches): Similar to above, except with cast iron body and bronze trim.

2.2 WATER PRESSURE REDUCING VALVE AND CONNECTIONS

A. Single-seated, for dead end service for 200 to 850 kPa (30 to 125 pounds) range on low pressure side. Composition diaphragm and stainless steel springs, bronze body with threaded connections for sizes 15 to 55 mm (1/2 to 2 inch), cast iron or semi-steel body with brass or bronze trimmings and flanged connections for sizes 15 to 50 mm (2-1/2 to 4 inch).

B. Operation: Diaphragm and spring to act directly on valve stem. Delivered pressure shall vary not more than one kPa for each 10 kPa (one pound for each 10 pounds) variation on inlet pressure.

C. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.

D. Connections Valves and Strainers: Install shut off valve on each side of reducing valve and full sized bypass with globe valve. Install

strainer on inlet side of, and same size as pressure reducing valve. Install pressure gage on low pressure side of line.

2.3 AIR PRESSURE REDUCING VALVE AND CONNECTIONS

Under seventy-five millimeters (3 inches), bronze body and trim, 75 mm (3 inches) and over, cast-iron body with bronze trim. Single seated, for dead end service for 200 to 1025 kPa (30 to 150 pounds) range on low pressure side. Composition diaphragm and bronze spring to act directly on valve stem. Delivered pressure shall not vary more than one kPa for each 10 kPa (one pound for each 10 pounds) variation in inlet pressure.

2.4 BACKWATER VALVE

Flap type, hinged or pivoted, with revolving disc. Cast iron body with cleanout of sufficient size to permit removal of interior parts. Hinge, pivot, disc and seat shall be nonferrous metal. Normal position of disc shall be slightly open. Extend the cleanout to the finished floor and fit with threaded countersunk plug. Provide clamping device wherever the cleanout extends through the membrane waterproofing.

2.5 BACKFLOW PREVENTERS

A. Provide a backflow prevention device at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. Device shall be certified by the American Society of Sanitary Engineers. Listed below is a partial list of connection to the potable water system which shall be protected against backflow or back siphonage.

B. Reduced Pressure Backflow Preventer: ASSE 1013.
   1. Deionizers.
   2. Sterilizers.
   3. Stills.
   4. Dialysis, Deionized or Reverse Osmosis Water Systems.
   5. Water make-up to heating systems, cooling tower, chilled water system, and generators.
   6. Water service entrance from loop system.

C. Pressure Type: ASSE 1020
   1. Water make-up to heating systems, cooling tower, chilled water system, and generators.
   2. Dental equipment.
   3. Print washer.

D. Atmospheric Vacuum Breaker: ASSE 1001

1. Hose bibs and sinks w/threaded outlets.
2. Disposers.
3. Showers (telephone type).
4. Hydrotherapy units.
5. Autopsy - on each hot and cold water outlet at each table or sink.
6. All kitchen equipment, if not protected by air gap.
7. Ventilating hoods w/washdown system.
8. Film processor.
9. Detergent system.
10. Dental equipment.
11. Fume hoods.
12. Glassware washers.

E. Double Check Detector Backflow Prevention Assembly: Fire service. ASSE 1015.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the PHCC National Standard Plumbing Code and the following:

1. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Install valve in each water connection to fixture.
2. Install union and shut-off valve on pressure piping at connections to equipment.
3. Backflow prevention device shall be installed in an accessible location, 5 (five) feet above finish floor.

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SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

A. Penetrations in rated enclosures: Section 07 84 00, FIRESTOPPING.

B. Preparation and finish painting and identification of piping systems: Section 09 91 00, PAINTING.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Pipe Insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Piping.
2. Strainers.
3. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

A-A-1427C.....Sodium Hypochlorite Solution

A-A-59617.....Unions, Brass or Bronze Threaded, Pipe Connections and Solder-Joint Tube Connections

C. American National Standards Institute (ANSI):

American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A13.1-96.....Scheme for Identification of Piping Systems

B16.3-98.....Malleable Iron Threaded Fittings ANSI/ASME

B16.4-98.....Cast Iron Threaded Fittings Classes 125 and 250 ANSI/ASME

B16.9-01.....Factory-Made Wrought Steel Buttwelding Fittings ANSI/ASME

B16.11-01.....Forged Steel Fittings, Socket-Welding and Threaded ANSI/ASME

B16.12-98.....Cast Iron Threaded Drainage Fittings ANSI/ASME

B16.15-85(R 1994).....Cast Bronze Threaded Fittings ANSI/ASME

B16.18-01.....Cast Copper Alloy Solder-Joint Pressure Fittings ANSI/ASME

B16.22-01.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings ANSI/ASME Element ANSI/ASME

D. American Society for Testing and Materials (ASTM):

A47-99.....Ferritic Malleable Iron Castings Revision 1989

A53-02.....Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless

A74-03.....Cast Iron Soil Pipe and Fittings

A183-83(R1998).....Carbon Steel Track Bolts and Nuts

A312-03.....Seamless and Welded Austenitic Stainless Steel Pipe

A536-84(R1999) E1.....Ductile Iron Castings

A733-03.....Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

B32-03.....Solder Metal

B61-02.....Steam or Bronze Castings

B62-02.....Composition Bronze or Ounce Metal Castings

B75-99(Rev A).....Seamless Copper Tube

B88-03.....Seamless Copper Water Tube

B584-00.....Copper Alloy Sand Castings for General Applications Revision A

B687-99.....Brass, Copper, and Chromium-Plated Pipe Nipples

C564-03.....Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D2000-01.....Rubber Products in Automotive Applications

D4101-03b Propylene Plastic Injection and Extrusion Materials

D2447-93.....Polyethylene (PE) Plastic Pipe, Schedule 40 and 80, Based on Outside Diameter

D2564-94.....Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D2665-94 Revision A.....Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D4101-03b.....Propylene Plastic Injection and Extrusion Materials

E1120.....Standard Specification For Liquid Chlorine

E1229.....Standard Specification For Calcium Hypochlorite

E. American Water Works Association (AWWA):

C110-03/ A21.10-03.....Ductile Iron and Gray Iron Fittings - 75 mm thru 1200 mm (3 inch thru 48 inches) for Water and other liquids AWWA/ ANSI

C151-00/ A21.51-02.....Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids AWWA/ ANSI

C203-02.....Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied AWWA/ ANSI

C651-99.....Disinfecting Water Mains

F. American Welding Society (AWS):

A5.8-92.....Filler Metals for Brazing

G. National Association of Plumbing - Heating - Cooling Contractors (PHCC):

National Standard Plumbing Code - 1996

H. International Association of Plumbing and Mechanical Officials (IAPMO):

Uniform Plumbing Code - 2000

IS6-93.....Installation Standard

I. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-72-99.....Ball Valves With Flanged or Butt Welding For General Purpose

SP-110-96.....Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

J. American Society of Sanitary Engineers (ASSE):

1001-02.....Pipe Applied Atmospheric Type Vacuum Breakers

1018-01.....Performance for trap seal primer valve-water supply fed

1020-04.....Vacuum Breakers, Anti-Siphon, Pressure Type

K. Plumbing and Drainage Institute (PDI):

PDI WH-201.....Water Hammer Arrestor

PART 2 - PRODUCTS

2.1 INTERIOR DOMESTIC WATER PIPING

A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 150 mm (6 inches) and larger, stainless, steel ASTM A312, schedule 10 may be used.

B. Fittings for Copper Tube:

1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints.
2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

C. Fittings for Stainless Steel:

1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.
2. Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or Malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

D. Adapters: Provide adapters for joining screwed pipe to copper tubing.

E. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.

F. Brazing alloy: AWS A5.8, Classification BCuP.

G. Reagent Grade Water Piping and Dialysis Water Piping:

1. Polypropylene, ASTM D4101, Schedule 80 pressure pipe with dimensions in conformance with ASTM D2447, but without additions of modifiers, plasticizers, colorants, stabilizers or lubricants. This virgin un-plasticized pipe and fittings shall transport 10 megohm water with no loss of purity. Provide socket fusion joints.
2. Polyethylene, food and medical grade, capable of transporting 10 megohm water with no loss of purity. Processed by continuous

compression molding without the addition of fillers, polymer modifiers or processing aids. Uniform color with no cracks, flaws, blisters or other imperfections in appearance. Provide heat fusion butt welded joints. In accordance with manufacturer's recommendations, provide continuous channel support under all horizontal piping.

2.2 EXPOSED WATER PIPING

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
   1. Pipe: Fed. Spec. WW-P-351, standard weight.
   2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
   3. Nipples: ASTM B 687, Chromium-plated.
   4. Unions: Mss SP-72, SP-110, Brass or Bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

2.3 ETO WATER PIPING

Stainless steel, ASTM A312, Schedule 10 with stainless steel butt welded fittings.

2.4 TRAP PRIMER WATER PIPING:

A. Pipe: Copper tube, ASTM B88, type K, hard drawn.

B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.

C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

2.5 WATERPROOFING

A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.

B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.

C. Walls: See detail shown on drawings.

2.6 STRAINERS

A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.

B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.

C. Body: Smaller than 80 mm (3 inches), brass or bronze; 80 mm (3 inches) and larger, cast iron or semi-steel.

2.7 DIELECTRIC FITTINGS

Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.8 STERILIZATION CHEMICALS

A. Liquid Chlorine: ASTM E1120.

B. Hypochlorite: ASTM E1229, or Fed. Spec. AA-1427C, grade B.

2.9 WATER HAMMER ARRESTER:

Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N 0-rings pressure packed and lubricated with FDA approved Dow Corning No. 11 silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI WH 201). Unit shall be as manufactured by Precision Plumbing Products Inc., Watts or Sioux Chief. Provide water hammer arrestors at all solenoid valves, at all groups of two or more flush valves, at all quick opening or closing valves, and at all medical washing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the PHCC National Standard Plumbing Code and the following:

1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.

3. All pipe runs shall be laid out to avoid interference with other work.
4. Install union and shut-off valve on pressure piping at connections to equipment.
5. Pipe Hangers, Supports and Accessories:
   a. All piping shall be supported per of the National Standard Plumbing Code, Chapter No. 8.
   b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
   c. Floor, Wall and Ceiling Plates, Supports, Hangers:
      1) Solid or split unplated cast iron.
      2) All plates shall be provided with set screws.
      3) Pipe Hangers: Height adjustable clevis type.
      4) Adjustable Floor Rests and Base Flanges: Steel.
      5) Concrete Inserts: "Universal" or continuous slotted type.
      6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
      7) Riser Clamps: Malleable iron or steel.
      8) Rollers: Cast iron.
      9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
      10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
      11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.

6. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
   a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
   b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

B. Piping shall conform to the following:
1. Domestic Water:
   a. Where possible, grade all lines to facilitate drainage. Provide drain valves at bottom of risers. All unnecessary traps in circulating lines shall be avoided.
   b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS

A. General: Test system either in its entirety or in sections.
B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.
C. Reagent Grade Water Systems: Fill system with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage during inspection and prove tight.
D. All Other Piping Tests: Test new installed piping under 1 1/2 times actual operating conditions and prove tight.

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SECTION 22 13 00
FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 DESCRIPTION

Sanitary sewerage systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

A. Penetrations in rated enclosures: Section 07 84 00, FIRESTOPPING.

B. Preparation and finish painting and identification of piping systems: Section 09 91 00, PAINTING.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Pipe Insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Piping.
2. Floor Drains.
3. Cleanouts.
4. All items listed in Part 2 - Products.

C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI):

American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A112.1.1M-91.....Floor Drains ANSI/ASME

A13.1-96.....Scheme for Identification of Piping Systems

B16.3-98.....Malleable Iron Threaded Fittings ANSI/ASME

B16.4-98.....Cast Iron Threaded Fittings Classes 125 and 250 ANSI/ASME

B16.12-98.....Cast Iron Threaded Drainage Fittings ANSI/ASME

B16.15-85(R 1994).....Cast Bronze Threaded Fittings ANSI/ASME Element ANSI/ASME

C. American Society for Testing and Materials (ASTM):

A47-99.....Ferritic Malleable Iron Castings Revision 1989

A53-02.....Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless

A74-03.....Cast Iron Soil Pipe and Fittings

A183-83(R1998).....Carbon Steel Track Bolts and Nuts

A536-84(R1999) E1.....Ductile Iron Castings

B32-03.....Solder Metal

B75-99(Rev A).....Seamless Copper Tube

B306-02.....Copper Drainage Tube (DWV)

B584-00.....Copper Alloy Sand Castings for General Applications Revision A

C564-03.....Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D2000-01.....Rubber Products in Automotive Applications

D2564-94.....Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D2665-94 Revision A.....Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D. National Association of Plumbing - Heating - Cooling Contractors (PHCC):

National Standard Plumbing Code - 1996

E. Cast Iron Soil Pipe Institute (CISPI):

301-04.....Hubless Cast Iron Soil and Fittings

F. International Association of Plumbing and Mechanical Officials (IAPMO):

Uniform Plumbing Code - 2000

IS6-93.....Installation Standard

G. American Society of Sanitary Engineers (ASSE):

1018-01.....Performance for trap seal primer valve-water supply fed

H. Factory Mutual (FM):

a. Coupling Used in Hubless Cast Iron Systems for Drains, Waste and Vent Systems.

I. Plumbing and Drainage Institute (PDI):

PDI WH-201.....Water Hammer Arrestor

PART 2 - PRODUCTS

2.1 SANITARY PIPING

A. Cast Iron Soil Pipe and Fittings: Used for pipe buried in or in contact with earth and for extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls and interior waste and vent piping above grade. Pipe shall be bell and spigot, modified hub, or plain end (no-hub) as required by selected jointing method:

1. Material, (Pipe and Fittings): ASTM A74, C1SP1-301, Service Class.
2. Joints: Provide any one of the following types to suit pipe furnished.
   a. Lead and oakum and caulked by hand.
   b. Double seal, compression-type molded neoprene gasket. Gaskets shall suit class of pipe being jointed.
   c. Mechanical: Meet the requirements and criteria for pressure, leak, deflection and shear tests as outlined in Factory Mutual No. 1680 for Class 1 couplings.
      1) Stainless steel clamp type coupling of elastomeric sealing sleeve, ASTM C564 and a Series 300 stainless steel shield and clamp assembly. Sealing sleeve with center-stop to prevent contact between pipes/fittings being joined shall be marked ASTM C564.
      2) Cast Iron coupling with neoprene gasket and stainless steel bolts and nuts.
   d. Mechanical Grooved Couplings: Shall consist of ductile iron (ASTM A536, Grade 65-45-12), or malleable iron (ASTM A47, Grade 32510) housings, a pressure responsive elastomeric gasket (ASTM D2000), and steel track head bolts. Shall be for use on pipe and fittings grooved to the manufacturer's specifications. Couplings and fittings to be of the same manufacturer.
   e. Adapters: Where service weight pipe is connected to extra heavy pipe and extra heavy fittings of chair carriers, provide adapters or similar system to make tight, leakproof joints.

B. Steel Pipe and Fittings: May be used for vent piping above grade.

1. Pipe Galvanized: ASTM A53, standard weight.
2. Fittings:
   a. Soil, Waste and Drain Piping: Cast iron, ANSI B16.12, threaded, galvanized.

b. Sanitary and Exhaust Vent Piping: Malleable iron, ANSI B16.3, or cast iron, ANSI B16.4. All piping shall be of the same kind. Couplings of vent piping may be standard couplings furnished with pipe.

c. Unions: Tucker connection or equivalent type throughout.

d. Mechanical Grooved Couplings: Shall consist of ductile iron (ASTM A536, Grade 65-45-12), or malleable iron (ASTM A47, Grade 32510) housings, a pressure responsive elastomeric gasket (ASTM D2000), and steel track head bolts. Shall be for use on pipe and fittings grooved to the manufacturer's specifications. Couplings and fittings to be of the same manufacturer.

C. Copper Tube, (DWV): May be used for piping above ground, except for urinal drains.

1. Tube: ASTM B306.

2. Fittings:

a. Solder type.

b. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper conforming to ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting conforming to ASTM B584, CDA 844(81-3-7-9). Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housings, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

3. Joints: ASTM B32, 50/50, special alloy, lead free. Solder using non-corrosive flux.

D. Polyvinyl Chloride (PVC): Schedule 40. Shall not be used where waste temperature may exceed 60°C (140°F), such as mechanical equipment rooms, and kitchen, SPD, and sterilizer areas. In nursing homes, restrict PVC to patient toilet areas and use other specified material for trunk sewer. PVC shall not be used in waste risers due to higher noise than other specified material.

1. Pipe: Shall be manufactured from Type I normal impact resins in conformance with ASTM D2665 and ASTM B16.12.

2. Fittings:

a. Solvent Welded Socket Type: Use solvent cement, ASTM D2564.

b. Threaded Type: Molded threads only. Use tape or lubricant specifically intended for use with PVC plastic pipe.

2.2 EXPOSED WASTE PIPING

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed waste piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
   1. Pipe: Fed. Spec. WW-P-351, standard weight.
   2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
   3. Nipples: ASTM B 687, Chromium-plated.
   4. Unions: Brass or Bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

2.3 CLEANOUTS

A. Same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Provide a minimum clearance of 600 mm (24 inches) for the rodding.

B. In Floors: Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. Unit shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, provide clamping collars on the cleanouts. Cleanouts shall consist of "Y" fittings and 3 mm (1/8 inch) bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, provide carpet cleanout markers. Provide two way cleanouts where indicated on drawings.

C. Provide cleanouts at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. Extend the cleanouts to the wall access cover. Cleanout shall consist of sanitary tees. Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral

trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required by the NPHCC National Standard Plumbing Code.

D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.4 FLOOR DRAINS

A. ANSI A112.21.1. Provide a caulking flange for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe, and side outlet when shown. Provide membrane clamp and extensions if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening will not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, provide a 2.2 kg (16-ounce) soft copper membrane, 600 mm (24 inches) square.

B. Type C: Cast iron body, double drainage pattern, clamping device, light duty square or round nickel bronze adjustable strainer and grate with vandal proof screws. One hundred fifty millimeter (6 inch) minimum square grate.

C. Open Sight/Hub Drains (OSD): Shall be cast iron, constructed as shown by detail.

2.5 TRAPS

Provide on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.6 TRAP PRIMERS

A. Trap Primer (TP-1): Electronic type.

1. Controller: Programmable, solid state, 6 zone, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup,

120VAC to 24VAC internal transformer, fuse protected circuitry, UL listed, 120VAC input-24VAC output, constructed of enameled steel or plastic, equal to Toro Model Vision.

2. Solenoid Valve: Brass body, Buna “N” seats, normally closed, 125 psi rated, 24VAC, equal to ASCO model 8210.
3. Control Wiring: Control wiring to be copper in accordance with NEC 1990, Article 725 and not less than 18 gauge. All wiring shall be in conduit and in accordance with Division 26 of the specifications.

2.7 WATERPROOFING

A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.
C. Walls: See detail shown on drawings.

2.8 DIELECTRIC FITTINGS

Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the PHCC National Standard Plumbing Code and the following:
1. Install branch piping for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
3. All pipe runs shall be laid out to avoid interference with other work.
4. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Install valve in each water connection to fixture.
5. All gravity waste drain lines inside the building with vertical drops over 6 m (20 feet) shall be provided with joint restraint on the vertical drop and horizontal offset or branch below the vertical

drop. Joint restraint shall be accomplished by threaded, soldered, lead and oakum or grooved joints or a combination of pipe clamps and tie-rods as detailed in NFPA 24. Vertical joint restraint shall be provided from the fitting at the bottom of the vertical drop through every joint up to the riser clamp at the floor penetration of the floor above. Horizontal joint restraint shall be provided from the same fitting at the bottom of the vertical drop through every joint on the horizontal offset or branch for a minimum of 18 m (60 feet) or to anchoring point from the building structure. Joint restraint below ground shall be accomplished by thrust blocks detailed in NFPA 24.

6. Pipe Hangers, Supports and Accessories:
   a. All piping shall be supported per of the National Standard Plumbing Code, Chapter No. 8.
   b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
   c. Floor, Wall and Ceiling Plates, Supports, Hangers:
      1) Solid or split unplated cast iron.
      2) All plates shall be provided with set screws.
      3) Pipe Hangers: Height adjustable clevis type.
      4) Adjustable Floor Rests and Base Flanges: Steel.
      5) Concrete Inserts: "Universal" or continuous slotted type.
      6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
      7) Riser Clamps: Malleable iron or steel.
      8) Rollers: Cast iron.
      9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
      10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.

11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.

7. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
8. Penetrations:
   a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
   b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

B. Piping shall conform to the following:
   1. Waste and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm (3 inches) and smaller	1 : 50 (1/4" to the foot).
80 mm (4 inches) and larger	1 : 100 (1/8" to the foot).

   2. Exhaust Vent: Extend separately through roof. Sanitary vents shall not connect to exhaust vents.

3.2 TESTS

A. General: Test system either in its entirety or in sections.
B. Waste Systems: Conduct before trenches are backfilled or fixtures are connected. Conduct water test or air test, as directed.
   1. Water Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each

opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

2. Air Test: Maintain air pressure of 35 kPa (5 psi) gage for at least 15 minutes without leakage. Use force pump and mercury column gage.
3. Final Tests: Either one of the following tests may be used.
   a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (one inch of water) with a smoke machine. Chemical smoke is prohibited.
   b. Peppermint Test: Introduce (two ounces) of peppermint into each line or stack.

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SECTION 22 14 00
FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

Storm drainage systems, including piping and all necessary accessories as designated in this section.

1.2 RELATED WORK

A. Penetrations in rated enclosures: Section 07 84 00, FIRESTOPPING.

B. Preparation and finish painting and identification of piping systems: Section 09 91 00, PAINTING.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Pipe Insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Piping.
2. Cleanouts.
3. All items listed in Part 2 - Products.

C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

A-A-59617.....Unions, Brass or Bronze Threaded, Pipe Connections and Solder-Joint Tube Connections

C. American National Standards Institute (ANSI):

American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A13.1-96.....Scheme for Identification of Piping Systems

B16.3-98.....Malleable Iron Threaded Fittings ANSI/ASME

B16.9-01.....Factory-Made Wrought Steel Buttwelding Fittings ANSI/ASME

B16.11-01.....Forged Steel Fittings, Socket-Welding and Threaded ANSI/ASME

B16.12-98.....Cast Iron Threaded Drainage Fittings ANSI/ASME

B16.15-85(R 1994).....Cast Bronze Threaded Fittings ANSI/ASME

B16.18-01.....Cast Copper Alloy Solder-Joint Pressure Fittings ANSI/ASME

B16.22-01.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings ANSI/ASME

D. American Society for Testing and Materials (ASTM):

A47-99.....Ferritic Malleable Iron Castings Revision 1989

A53-02.....Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless

A74-03.....Cast Iron Soil Pipe and Fittings

A183-83(R1998).....Carbon Steel Track Bolts and Nuts

A312-03.....Seamless and Welded Austenitic Stainless Steel Pipe

A536-84(R1999) E1.....Ductile Iron Castings

A733-03.....Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

B32-03.....Solder Metal

B61-02.....Steam or Bronze Castings

B62-02.....Composition Bronze or Ounce Metal Castings

B75-99(Rev A).....Seamless Copper Tube

B88-03.....Seamless Copper Water Tube

B306-02.....Copper Drainage Tube (DWV)

B584-00.....Copper Alloy Sand Castings for General Applications Revision A

B687-99.....Brass, Copper, and Chromium-Plated Pipe Nipples

C564-03.....Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D2000-01.....Rubber Products in Automotive Applications

D4101-03b Propylene Plastic Injection and Extrusion Materials

D2447-93.....Polyethylene (PE) Plastic Pipe, Schedule 40 and 80, Based on Outside Diameter

D2564-94.....Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D2665-94 Revision A.....Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D4101-03b.....Propylene Plastic Injection and Extrusion Materials

E. American Welding Society (AWS):

A5.8-92.....Filler Metals for Brazing

F. National Association of Plumbing - Heating - Cooling Contractors (PHCC):

National Standard Plumbing Code - 1996

G. Cast Iron Soil Pipe Institute (CISPI):

301-04.....Hubless Cast Iron Soil and Fittings

H. International Association of Plumbing and Mechanical Officials (IAPMO):

Uniform Plumbing Code - 2000

IS6-93.....Installation Standard

I. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-72-99.....Ball Valves With Flanged or Butt Welding For General Purpose

SP-110-96.....Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

J. Factory Mutual (FM):

a. Coupling Used in Hubless Cast Iron Systems for Drains, Waste and Vent Systems.

PART 2 - PRODUCTS

2.1 STORM WATER DRAIN AND VENT PIPING

A. Cast Iron Soil Pipe and Fittings: Used for pipe buried in or in contact with earth and for extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls and interior waste and vent piping above grade. Pipe shall be bell and spigot, modified hub, or plain end (no-hub) as required by selected jointing method:

1. Material, (Pipe and Fittings): ASTM A74, C1SP1-301, Service Class.
2. Joints: Provide any one of the following types to suit pipe furnished.
   a. Lead and oakum and caulked by hand.
   b. Double seal, compression-type molded neoprene gasket. Gaskets shall suit class of pipe being jointed.
   c. Mechanical: Meet the requirements and criteria for pressure, leak, deflection and shear tests as outlined in Factory Mutual No. 1680 for Class 1 couplings.

1) Stainless steel clamp type coupling of elastomeric sealing sleeve, ASTM C564 and a Series 300 stainless steel shield and clamp assembly. Sealing sleeve with center-stop to prevent contact between pipes/fittings being joined shall be marked ASTM C564.
2) Cast Iron coupling with neoprene gasket and stainless steel bolts and nuts.

d. Mechanical Grooved Couplings: Shall consist of ductile iron (ASTM A536, Grade 65-45-12), or malleable iron (ASTM A47, Grade 32510) housings, a pressure responsive elastomeric gasket (ASTM D2000), and steel track head bolts. Shall be for use on pipe and fittings grooved to the manufacturer's specifications. Couplings and fittings to be of the same manufacturer.

e. Adapters: Where service weight pipe is connected to extra heavy pipe and extra heavy fittings of chair carriers, provide adapters or similar system to make tight, leakproof joints.

B. Steel Pipe and Fittings: May be used for vent piping and storm water piping above grade.

1. Pipe Galvanized: ASTM A53, standard weight.
2. Fittings:

a. Drain Piping: Cast iron, ANSI B16.12, threaded, galvanized.

c. Unions: Tucker connection or equivalent type throughout.

d. Mechanical Grooved Couplings: Shall consist of ductile iron (ASTM A536, Grade 65-45-12), or malleable iron (ASTM A47, Grade 32510) housings, a pressure responsive elastomeric gasket (ASTM D2000), and steel track head bolts. Shall be for use on pipe and fittings grooved to the manufacturer's specifications. Couplings and fittings to be of the same manufacturer.

C. Copper Tube, (DWV): May be used for piping above ground.

1. Tube: ASTM B306.
2. Fittings:

a. Solder type.

b. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper conforming to ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting conforming to ASTM B584, CDA 844(81-3-7-9). Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housings, with EPDM

gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

3. Joints: ASTM B32, 50/50, special alloy, lead free. Solder using non-corrosive flux.

D. Polyvinyl Chloride (PVC): Schedule 40. Shall not be used where waste temperature may exceed 60°C (140°F), such as mechanical equipment rooms, and kitchen, SPD, and sterilizer areas. In nursing homes, restrict PVC to patient toilet areas and use other specified material for trunk sewer. PVC shall not be used in waste risers due to higher noise than other specified material.

1. Pipe: Shall be manufactured from Type I normal impact resins in conformance with ASTM D2665 and ASTM B16.12.
2. Fittings:
   a. Solvent Welded Socket Type: Use solvent cement, ASTM D2564.
   b. Threaded Type: Molded threads only. Use tape or lubricant specifically intended for use with PVC plastic pipe.

2.2 CLEANOUTS

A. Same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts for chemical waste drain pipe shall be of same material as the pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Provide a minimum clearance of 600 mm (24 inches) for the rodding.

B. In Floors: Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. Unit shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, provide clamping collars on the cleanouts. Cleanouts shall consist of "Y" fittings and 3 mm (1/8 inch) bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, provide carpet cleanout markers. Provide two way cleanouts where indicated on drawings.

C. Provide cleanouts at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. Extend the cleanouts to the wall access cover. Cleanout shall consist of sanitary tees. Furnish

nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required by the NPHCC National Standard Plumbing Code.

D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.3 WATERPROOFING

A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.

B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.

C. Walls: See detail shown on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the PHCC National Standard Plumbing Code and the following:

1. Install branch piping from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
3. All pipe runs shall be laid out to avoid interference with other work.
4. Install union and shut-off valve on pressure piping at connections to equipment.
5. All gravity waste drain lines inside the building with vertical drops over 6 m (20 feet) shall be provided with joint restraint on the vertical drop and horizontal offset or branch below the vertical drop. Joint restraint shall be accomplished by threaded, soldered,

lead and oakum or grooved joints or a combination of pipe clamps and tie-rods as detailed in NFPA 24. Vertical joint restraint shall be provided from the fitting at the bottom of the vertical drop through every joint up to the riser clamp at the floor penetration of the floor above. Horizontal joint restraint shall be provided from the same fitting at the bottom of the vertical drop through every joint on the horizontal offset or branch for a minimum of 18 m (60 feet) or to anchoring point from the building structure. Joint restraint below ground shall be accomplished by thrust blocks detailed in NFPA 24.

6. Pipe Hangers, Supports And Accessories:
   a. All piping shall be supported per of the National Standard Plumbing Code, Chapter No. 8.
   b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
   c. Floor, Wall and Ceiling Plates, Supports, Hangers:
      1) Solid or split unplated cast iron.
      2) All plates shall be provided with set screws.
      3) Pipe Hangers: Height adjustable clevis type.
      4) Adjustable Floor Rests and Base Flanges: Steel.
      5) Concrete Inserts: "Universal" or continuous slotted type.
      6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
      7) Riser Clamps: Malleable iron or steel.
      8) Rollers: Cast iron.
      9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
      10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
      11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers,

supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.

7. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
8. Penetrations:
   a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
   b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

B. Piping shall conform to the following:
   1. Storm Water Drain and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm (3 inches) and smaller	1 : 50 (1/4" to the foot).
80 mm (4 inches) and larger	1 : 100 (1/8" to the foot).

   2. Exhaust Vent: Extend separately through roof. Sanitary vents shall not connect to exhaust vents.

3.2 TESTS

A. General: Test system either in its entirety or in sections.
B. Storm Water Drain: Conduct before trenches are backfilled or fixtures are connected. Conduct water test or air test, as directed.
   1. Water Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of

water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

2. Air Test: Maintain air pressure of 35 kPa (5 psi) gage for at least 15 minutes without leakage. Use force pump and mercury column gage.
3. Final Tests: Either one of the following tests may be used.
   a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (one inch of water) with a smoke machine. Chemical smoke is prohibited.
   b. Peppermint Test: Introduce (two ounces) of peppermint into each line or stack.

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

1.2 RELATED WORK

A. Sealing between fixtures and other finish surfaces: Section 07 92 00, JOINT SEALANTS.

B. Flush panel access doors: Section 08 31 13, ACCESS DOORS AND FRAMES.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit plumbing fixture information in an assembled brochure, showing cuts and full detailed description of each fixture.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standard Institute (ANSI):
The American Society of Mechanical Engineers (ASME):
A112.6.1M-02(R2008).....Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
A112.19.1M-04.....Enameled Cast Iron Plumbing fixtures
A112.19.2M-03(R2008)....Vitreous China Plumbing Fixtures
A112.19.3-2001(R2008)...Stainless Steel Plumbing fixtures (Designed for Residential Use)

C. American Society for Testing and Materials (ASTM):
A276-2003.....Stainless and Heat-Resisting Steel Bars and Shapes

D. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM AMP 500-505
Metal Finishes Manual (1988)

E. American Society of Sanitary Engineers (ASSE):
1016-05.....Performance Requirements for Individual Thermostatic, Pressure Balancing and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings

F. National Sanitation Foundation (NSF)/American National Standards Institute (ANSI):
61-03.....Drinking Water System Components-Health Effects

G. American with Disabilities Act(A.D.A) Section 4-19.4 Exposed Pipes and Surfaces

PART 2 - PRODUCTS

2.1 STAINLESS STEEL

A. Corrosion-resistant Steel (CRS):
1. Plate, Sheet and Strip: CRS flat products shall conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
2. Finish: Exposed surfaces shall have standard polish (ground and polished) equal to NAAMM finish Number 4.

B. Die-cast zinc alloy products are prohibited.

2.2 STOPS

A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.

B. Furnish keys for lock shield stops to Resident Engineer.

C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.

D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe, i.e. red brass pipe nipple.

E. Psychiatric Area: Provide stainless steel drain guard for all lavatories not installed in casework.

2.3 ESCUTCHEONS

Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.4 LAMINAR FLOW CONTROL DEVICE

A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.

B. Flow Control Restrictor:

1. Capable of restricting flow from 95 to 110 mL/s (1.5 to 1.7 gpm) for lavatories; 125 to 140 mL/s (2.0 to 2.2 gpm) for sinks P-505 through P-520, P-524 and P-528; and 170 to 190 mL/s (2.75 to 3.0 gpm) for dietary food preparation and rinse sinks.
2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 and 550 kPa (25 and 80 psi).
3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-clearing action, and is capable of easy manual cleaning.

C. Device manufactured by OMNI Products, Inc. or equal.

2.5 CARRIERS

A. ASME/ANSI A112.6.1M, with adjustable gasket faceplate chair carriers for wall hung closets with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down.

B. ASME/ANSI A112.6.1M, lavatory, chair carrier for thin wall construction. All lavatory chair carriers shall be capable of supporting the lavatory with a 250-pound vertical load applied at the front of the fixture.

C. Where lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers. The drainage fitting of the back to back carrier shall be so constructed that it prevents the discharge from one fixture from flowing into the opposite fixture.

2.6 WATER CLOSETS

A. (P-101) Water Closet (Floor Mounted, ANSI 112.19.2M, Figure 6) - office and industrial, elongated bowl, siphon jet 6 L (1.6 gallons) per flush, floor outlet. Top of rim shall be 434 to 437 mm (17 1/8 inch to 17 1/4 inch)above finished floor.

1. Seat: Institutional/Industrial, extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel post. Seat shall be posture contoured body design. Color shall be white.

2. Fittings and Accessories: Gaskets - neoprene; bolts with chromium plated caps nuts and washers.
3. Flush valve: Large chloramines resistant diaphragm, semi-red brass valve body, exposed chrome plated, battery powered active infra-red sensor for automatic operation with courtesy flush button for manual operation, water saver design 6 L (1.6 gallons) per flush with maximum 10 percent variance, 25mm (one-inch) screwdriver back check angle stop with vandal resistant cap, adjustable tailpiece, a high back pressure vacuum breaker, spud coupling for 40 mm (1-1/2 inch) top spud, wall and spud flanges, and sweat solder adapter with cover tube and set screw wall flange. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM alloy classification for semi-red brass. Seat bumpers shall be integral part of flush valve. Set centerline of inlet 292 mm (11-1/2 inches) above rim.

2.7 LAVATORIES

A. Dimensions for lavatories are specified, Length by width (distance from wall) and depth.
B. Brass components in contact with water shall contain no more than 3 percent lead content by dry weight.
C. (P-408) Lavatory (ASME/ANSI A112.19.2M, Figure 16) straight back, approximately 450 by 380 mm (18 by 15 inches) and a 102 mm (4-inch) maximum apron, first quality vitreous china. Punching for faucet on 102 mm (4-inch) centers. Support lavatory to wall with steel wall plate. Set with rim 864 mm (34 inches) above finished floor:
   1. Faucet: Solid cast brass construction with washerless ceramic disc mixing cartridge type and centrally exposed rigid gooseneck spout Outlet 125-150 mm (5-6 inches) above rim. Provide laminar flow control device. One hundred two millimeters (4-inch) wrist blade type handles on faucets shall be cast, formed or drop forged copper alloy. Faucet, wall and floor escutcheons shall be either copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall be chrome plated with a smooth bright finish.
   2. Drain: Cast or wrought brass with flat grid strainer and offset tailpiece, chrome plated finish.
   3. Stops: Angle type. See paragraph 2.2. Stops
   4. Trap: Cast copper alloy, 40 by 32 mm (1-1/2 by 1-1/4 inch) P-trap. Adjustable with connected elbow and 1.4 mm thick (17 gauge) tubing

extension to wall. Exposed metal trap surface, and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to wall.

5. Provide cover for drain, stops and trap per A.D.A 4-19.4.

2.8 SINKS AND LAUNDRY TUBS

A. Dimensions for sinks and laundry tubs are specified, length by width (distance from wall) and depth.

B. (P-516) Sink (CRS, Single Compartment, Wall Hung) 14 gage CRS, approximately (21 by 20 inches) by (6-inches) deep with splash back. Provide rolled rim on front and ends. Corners and edges shall be well rounded. Support sink with 10 gage CRS brackets on ASME/ANSI A112.6.1M, Type I, chair carrier and secure fixture with minimum (3/8-inch) all-thread bracket studs and nuts. Set rim of sink (36-inches) above finished floor.

1. Faucet: Solid brass construction, combination faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, and swinging elevated spout, integral stops, mounted as close as possible to top of splash back. Wrist blade handles on faucet shall be cast, formed or drop forged copper alloy or CRS. Exposed metal parts, including exposed part under valve when in open position, shall have a smooth bright finish. Provide laminar flow control device.
2. Drain: Drain with strainer, stainless steel.
3. Trap: Cast copper alloy, (1-1/2 inch) P-trap. Adjustable with connected elbow and nipple to wall and escutcheon.
4. Provide cover for drain, stops and trap per A.D.A 4-19.4.

C. (P-528) Sink (CRS, Single Compartment, Counter Top ASME/ANSI A112.19.2M, Kitchen Sinks, Figure 5) self rimming, back faucet ledge, approximately (21 by 22 inches) with single compartment inside dimensions approximately (16 by 19 by 7 ½ inches) deep. Shall be minimum of thick (18 gauge) CRS. Corners and edges shall be well rounded:

1. Faucet: Solid brass construction, deck mounted combination faucet with monel or ceramic seats, removable replacement unit containing all parts subject to ware, swivel gooseneck spout with approximately 200 mm (8-inche) reach with spout outlet (6-inches above deck and, single lever. Faucet shall be polished chrome plated.
2. Drain: Drain plug with cup strainer, stainless steel.

3. Trap: Cast copper alloy (1-1/2 inch) P-trap with cleanout plug. Provide wall connection and escutcheon.
4. Provide cover for drain, stops and trap per A.D.A 4-19.4.

D. (P-530) Sink (CRS, Single Compartment with Drainboard, Wall Hung, Sensor Controls) 14 gauge CRS approximately 457 by 381 by 254 mm (18 by 15 inches by 10 inches) deep with 203mm (8-inch) splash back and drainboard at right or left as shown on the drawings. Overall dimensions (sink and drainboard), approximately 1200 mm (48-inches) long by 600 mm (24 inches) wide. Slope drainboard to bead, not less than 6 mm (1/4-inch) high, on front and ends. Corners and edges shall be well rounded. Support sink with 3.5 mm thick (10 gauge) CRS brackets on ASME/ANSI A112.6.1M, Type I, chair carrier and secure fixture with minimum 10 mm (3/8-inch) all-thread bracket studs and nuts. Set rim of sink 914 mm (36 inches) above finished floor.

1. Drain: Drain plug with cup strainers.
2. Trap: Cast copper alloy, 40 mm (1-1/2 inch) P-trap. Adjustable with connected elbow and nipple the wall and escutcheon.
3. Sensor Control: Provide an infra-red photocell sensor and solenoid valve to control flow automatically, thermostatic control valve with check stops, 24 volt transformer, wire box and steel access door with key operated cylinder lock see specification ACCESS DOORS. Operation: Breaking the light beam shall activate the water flow. Flow shall stop when the user moves from the light beam.
4. Gooseneck spout: Spout and trim shall be solid brass construction and be chromium plated with smooth bright finish. Provide laminar flow device.
5. Provide cover for drain, stops and trap per A.D.A 4-19.4.

2.9 EMERGENCY FIXTURES

A. (P-708) Emergency Eye and Face Wash (Deck Mounted): Swing activated, built-in flow regulator twin aerated sprays, flip-top dust caps, chrome plated, universal sign. Brass thermostatic mixing valve; A.N.S.I. Z358.1-2004.

B. (P-707) Emergency Shower and Eye and Face Wash (Free Standing):

1. Shower Head: Polished chrome plated, 200 mm (8 inches) in diameter, install head 2100 mm (84 inches) above floor. Equip with stay-open ball valve, chrome plated. Operate valve with 600 mm (24-inch) stainless steel pull-rod with triangle handle. Pull-down opens valve; push-up closes valve.

2. Emergency Eye and Face Wash: CRS receptor. Equipment with a 15 mm (1/2-inch) stay open ball valve operated by push flag handle. Mount eye and face wash spray heads 1065 mm (42 inches) above finished floor.
3. Shower head and emergency eye and face wash shall be mounted to stanchion with floor flange through floor waste connection and P-trap. Paint stanchion same color as room interior

2.10 DISPENSER, DRINKING WATER

A. Standard rating conditions: 10 degrees C (50 degrees F) water with 27 degrees C (80 degrees F) inlet water temperature and 32 degrees C (90 degrees F) ambient air temperature.

B. (P-604) Electric Water Cooler (Mechanically Cooled, Wall Hung, Self-contained, Wheelchair) bubbler style, 5 mL/s (5 gph) minimum capacity, lead free. Top shall be CRS anti-splash design. Cabinet, CRS, satin finish, approximately 450 by 450 by 635 mm (18 by 18 inches by 25 inches) high with mounting plate. Set bubbler 914 mm (36 inches) above finished floor. Unit shall be push bar operated with front and side bar and automatic stream regulator. All trim polished chrome plated.

2.11 HYDRANT, HOSE BIBB AND MISCELLANEOUS DEVICES

A. (P-807) Reagent Grade Water Faucet: Gooseneck, deck mounted for recirculating reagent grade water, forged brass valve body and 15 mm (1/2 inch) I.P.S. brass riser with polypropylene interior lining, polypropylene serrated hose end. Polypropylene inlet and outlet tube, compression control polypropylene diaphragm valve inside valve body. Provide inlet and outlet adapters. Color code faucets with full view plastic index buttons.

B. (TP1) Trap Primer:

1. Controller: Programmable, solid state, 6 zone, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup, 120 VAC to 24 VAC internal transformer, fuse protected circuitry, UL listed, 120VAC input-24VAC output, constructed of enameled stall or plastic, equal to Toro Model Vision.
2. Solenoid Valve: Brass body, Buna “N” seats, normally closed, 125.0-psi rated, 24 VAC, equal to ASCO model #8210.
3. Control Wiring: Control wiring to be copper in accordance with NEC 1990, Article 725 and not less than 18 gauge. All wiring shall be in conduit and in accordance with division 16 of the specifications.

PART 3 – EXECUTION

3.1 GENERAL

A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section 07 92 00, JOINT SEALANTS.

B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.

C. Through Bolts: For free standing marble and metal stud partitions refer to Section 10 21 13, TOILET COMPARTMENTS.

D. Toggle Bolts: For hollow masonry units, finished or unfinished.

E. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4-inch) diameter bolts, and to extend at least 75 mm (3-inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.

F. Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4-inch) threaded studs, and shall extend at least 35 mm (1-1/4 inches) into wall.

G. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

H. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.

I. Do not use aerators on lavatories and sinks.

3.2 CLEANING

At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

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SECTION 22 66 00
CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

Chemical waste systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

A. Penetrations in rated enclosures: Section 07 84 00, FIRESTOPPING.

B. Preparation and finish painting and identification of piping systems: Section 09 91 00, PAINTING.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Pipe Insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Piping.
2. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

A-A-59617.....Unions, Brass or Bronze Threaded, Pipe Connections and Solder-Joint Tube Connections

C. American National Standards Institute (ANSI):

American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A112.1.1M-91.....Floor Drains ANSI/ASME

A13.1-96.....Scheme for Identification of Piping Systems

B16.11-01.....Forged Steel Fittings, Socket-Welding and Threaded ANSI/ASME

B16.12-98.....Cast Iron Threaded Drainage Fittings ANSI/ASME

B16.15-85(R 1994).....Cast Bronze Threaded Fittings ANSI/ASME

D. American Society for Testing and Materials (ASTM):

A74-03.....Cast Iron Soil Pipe and Fittings

A183-83(R1998).....Carbon Steel Track Bolts and Nuts

A312-03.....Seamless and Welded Austenitic Stainless Steel Pipe

A733-03.....Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

C564-03.....Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D4101-03b Propylene Plastic Injection and Extrusion Materials

D2447-93.....Polyethylene (PE) Plastic Pipe, Schedule 40 and 80, Based on Outside Diameter

D2564-94.....Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D2665-94 Revision A.....Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D4101-03b.....Propylene Plastic Injection and Extrusion Materials

E. National Association of Plumbing - Heating - Cooling Contractors (PHCC):
National Standard Plumbing Code - 1996

F. Cast Iron Soil Pipe Institute (CISPI):
301-04.....Hubless Cast Iron Soil and Fittings

G. International Association of Plumbing and Mechanical Officials (IAPMO):
Uniform Plumbing Code - 2000
IS6-93.....Installation Standard

H. Factory Mutual (FM):
a. Coupling Used in Hubless Cast Iron Systems for Drains, Waste and Vent Systems.

PART 2 - PRODUCTS

2.1 CHEMICAL RESISTANT WASTE AND VENT PIPING

A. General: The material includes connecting fittings in stacks or mains.

B. Cast Iron: Acid resistant, close grained, cast iron pipe containing not less than 14.25 percent silicon:
1. Mechanical Joint: Stainless steel coupling, Series 300. Install couplings over one-piece, sleeve type gaskets. Gaskets shall be either of the following:
a. Sintered polytetrafluoroethyl surrounded with neoprene.

b. Inner layer of fluorocarbon resin, middle layer of fluorocarbon resin impregnated glass cloth, and outer wrap of neoprene.

2. Bell and Spigot Joint.

C. Polypropylene Plastic: ASTM D4101, Schedule 40, flame retardant. Pipe shall meet tolerances in accordance with ASTM D2447-93. Join pipe and fittings by heat fusion or mechanical joint in accordance with ASTM D2657. Must conform to National Sanitation Foundation requirements for corrosive waste service. Short turn elbows and sanitary tees are prohibited. Use standard DWV pattern for fittings. Mechanical joint fittings 38 thru 50 mm (1 1/2 thru 2 inches) shall be used for above grade vent piping and under counters within cabinet space.

D. Stainless Steel: Type AISI 316L, high-grade austenitic stainless steel, chemically descaled for enhanced corrosion resistance and matt silver finish. Furnish pipe and fittings with EPDM gasketed hub and spigot push-fit connection. Use conversion couplings where connections are made to other piping materials. Gasket exceptions:

1. Highly Corrosive Acids and Solvents or Elevated Temperatures: FPM gasket.

2. Petroleum Products Present: NBR gasket.

2.2 CLEANOUTS

A. Same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts for chemical waste drain pipe shall be of same material as the pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Provide a minimum clearance of 600 mm (24 inches) for the rodding.

B. In Floors: Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. Unit shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, provide clamping collars on the cleanouts. Cleanouts shall consist of "Y" fittings and 3 mm (1/8 inch) bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, provide carpet cleanout markers. Provide two way cleanouts where indicated on drawings.

C. Provide cleanouts at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor.

If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. Extend the cleanouts to the wall access cover. Cleanout shall consist of sanitary tees. Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required by the NPHCC National Standard Plumbing Code.

D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the PHCC National Standard Plumbing Code and the following:

1. Install branch piping for chemical waste piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
3. All pipe runs shall be laid out to avoid interference with other work.
4. All gravity waste drain lines inside the building with vertical drops over 6 m (20 feet) shall be provided with joint restraint on the vertical drop and horizontal offset or branch below the vertical drop. Joint restraint shall be accomplished by threaded, soldered, lead and oakum or grooved joints or a combination of pipe clamps and tie-rods as detailed in NFPA 24. Vertical joint restraint shall be provided from the fitting at the bottom of the vertical drop through every joint up to the riser clamp at the floor penetration of the floor above. Horizontal joint restraint shall be provided from the same fitting at the bottom of the vertical drop through every joint

on the horizontal offset or branch for a minimum of 18 m (60 feet) or to anchoring point from the building structure.

5. Pipe Hangers, Supports And Accessories:
   a. All piping shall be supported per of the National Standard Plumbing Code, Chapter No. 8.
   b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
   c. Floor, Wall and Ceiling Plates, Supports, Hangers:
      1) Solid or split unplated cast iron.
      2) All plates shall be provided with set screws.
      3) Pipe Hangers: Height adjustable clevis type.
      4) Adjustable Floor Rests and Base Flanges: Steel.
      5) Concrete Inserts: "Universal" or continuous slotted type.
      6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
      7) Riser Clamps: Malleable iron or steel.
      8) Rollers: Cast iron.
      9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
      10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
      11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
6. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

7. Penetrations:
   a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
   b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

B. Piping shall conform to the following:
   1. Chemical Resistant Waste and Vent and Silver Recovery:
      a. Where waste lines from fixtures are shown on plans to be chemical resistant, vents shall also be chemical resistant.
      b. PVC Pipe: Storage and installation shall comply with ASTM D2665.
      c. Mechanical Joint Polypropylene Pipe: This joint requires pregrooved pipe or cutting of a groove in each pipe section using a rotation cutting tool. Pitch shall be 6 mm (1/4 inch per foot) minimum. Do not install below grade. Do not install within 23 m (75 feet) of hot water appliances (autoclaves, dishwashers, sterilizers and similar equipment.
      d. Silicon cast iron pipe with bell and spigot joints and heat fusion polyproplene pipe may be used below grade under building.
      e. Do not install stainless steel mechanical joints below grade.
      f. Stainless Steel Piping: Join and support piping system per manufacturer's recommendations.

3.2 TESTS

A. General: Test system either in its entirety or in sections.
B. Chemical Resistant Waste and Silver Recovery Systems: Conduct before trenches are backfilled or fixtures are connected. Conduct water test or air test, as directed.
   1. Water Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10

feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

2. Air Test: Maintain air pressure of 35 kPa (5 psi) gage for at least 15 minutes without leakage. Use force pump and mercury column gage.
3. Final Tests: Either one of the following tests may be used.
   a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (one inch of water) with a smoke machine. Chemical smoke is prohibited.
   b. Peppermint Test: Introduce (two ounces) of peppermint into each line or stack.

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SECTION 22 67 22

PROCESSED WATER SYSTEMS FOR HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes reverse-osmosis-water piping.

1.3 DEFINITIONS

A. CPVC: Chlorinated polyvinyl chloride plastic.

B. PP: Polypropylene plastic.

C. PTFE: Polytetrafluoroethylene plastic.

D. PVC: Polyvinyl chloride plastic.

E. PVDF: Polyvinylidene fluoride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping with the following minimum working-pressure ratings, unless otherwise indicated:

1. Reverse-Osmosis-Water Piping: 50 psig (345 kPa), unless otherwise indicated or required by reverse-osmosis equipment manufacturer.

1.5 SUBMITTALS

A. Product Data: For each type of pipe and fitting indicated.

B. Welding certificates.

C. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing laboratory.

B. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

C. ASME Compliance: Comply with ASME B31.3, "Process Piping."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe and fittings from dirt and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

B. Transition Fittings: Couplings, flanges, or other manufactured fittings, same size as, with pressure rating at least equal to and ends compatible with piping to be joined.

2.3 PLASTIC PIPE AND FITTINGS

A. PP Pipe and Fittings: Made from ASTM D 4101, PP resin.

1. Manufacturers:
   a. Asahi/America.
   b. Fischer, George Inc.
   c. IPEX Inc.
   d. NIBCO INC.
   e. Orion.
   f. Town & Country Plastics, Inc.
2. Schedule 80, Pipe and Fittings: Pipe made to ASTM D 2447, Schedule 80 dimensions and socket- or butt-fusion or threaded fittings matching pipe Schedule 80 dimensions.

2.4 PLASTIC VALVES

A. PP Valves: Made from ASTM D 4101, PP resin.

1. Ball Valves, NPS 2 (DN 50) and Smaller: MSS SP-122, true union type with socket ends and pressure rating not less than 150 psig (1035 kPa) at 73 deg F (23 deg C).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to and of material same as, or compatible with, piping may be used in applications in this article, unless otherwise indicated.

B. Reverse-Osmosis-Water Piping: Use the following piping materials for each size range:

1. NPS 1 (DN 25) and Smaller: Schedule 80 PP pipe and fittings and heat-fusion or threaded joints.

3.2 VALVE APPLICATIONS

A. Valves for Reverse-Osmosis-Water Piping: Use the following valves for each piping material:

1. PP Pipe and Fittings: PP true union plastic valves.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of reverse-osmosis-water piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Refer to Division 22 Section "Common Work Results for Plumbing" for general piping installation requirements.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. PDVF Piping Joints: Make heat-fusion joints similar to procedure in ASTM D 2657 for polyolefin piping joints.

3.5 VALVE INSTALLATION

A. Install sectional valves close to mains on each branch and riser serving equipment.

B. Install shutoff valve on each supply to equipment.

3.6 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 15 Section "Noise

and Vibration Control."

B. Pipe hanger and support devices, install the following:

1. Clamps for Vertical Piping: MSS Type 8 or Type 42.
2. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, to minimum of 3/8 inch (10 mm).

F. Install padded hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 30 inches (750 mm) with 3/8-inch (10-mm) rod.

G. Install padded supports for vertical PP piping every 42 inches (1800 mm).

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect reverse-osmosis-water piping to equipment and service outlets with unions or flanges.

3.8 LABELING AND IDENTIFICATION

A. Install pipe markers and valve tags on piping. Distinguish between different systems and include direction of flow indication on each

pipe. Labeling and identification devices are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. Test new piping, and parts of existing piping that have been altered, extended, or repaired, for leaks and defects.

1. Schedule tests and their inspections by authorities having jurisdiction and Owner, with at least 48 hours' advance notice.
2. Do not cover or put into service before inspection and approval.
3. Test completed piping according to authorities having jurisdiction. If authorities having jurisdiction or Owner does not have published procedures, perform tests as follows:
   a. Hydrostatic Tests: Test piping at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 100 psig (690 kPa).
4. Replace leaking joints with new materials and retest until no leaks exist.
5. Submit separate reports for each test.

3.10 CLEANING

A. Use procedures prescribed by authorities having jurisdiction or Owner or, if not prescribed, use procedures described below:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Clean piping by flushing with system reverse-osmosis water.

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SECTION 23 05 11
COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this section applies to all sections of Division 23.

B. Definitions:

1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

A. Section 007200, GENERAL CONDITIONS.

B. Section 010000, GENERAL REQUIREMENTS.

C. Section 013323, SAMPLES AND SHOP DRAWINGS.

D. Section 078400, FIRESTOPPING.

E. Section 079200, JOINT SEALANTS.

F. Section 099100, PAINTING.

G. Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

H. Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

I. Section 230711, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

J. Section 233600, AIR TERMINAL UNITS.

K. Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

L. Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

M. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

N. Section 262911, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

A. Flow Rate Tolerance for HVAC Equipment: Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

B. Equipment Vibration Tolerance:

1. The allowable vibration tolerance is specified in Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Equipment specifications require factory balancing of equipment to this tolerance.
2. After air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

C. Products Criteria:
   1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
   2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
   3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
   4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
   5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
   6. Asbestos products or equipment or materials containing asbestos shall not be used.

D. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
   1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
   2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
   3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

E. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

F. Guaranty: Section 007200, GENERAL CONDITIONS.

G. Plumbing Systems: NAPHCC National Standard Plumbing Code.

H. Supports for sprinkler piping shall be in conformance with NFPA 13.

I. Supports for standpipe shall be in conformance with NFPA 14.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
   1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the Resident Engineer.
   2. Submit electric motor data and variable speed drive data with the driven equipment.
   3. Equipment and materials identification.
   4. Fire-stopping materials.
   5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
   6. Wall, floor, and ceiling plates.

C. Coordination Drawings: In accordance with Section 007200, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION. Provide detailed layout drawings of all piping and duct systems. In addition provide details of the following.
   1. Mechanical equipment rooms.
   2. Interstitial space.
   3. Hangers, inserts, supports, and bracing.
   4. Pipe sleeves.
   5. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

D. As-Built Ductwork Drawings in scale 1/4″ = 1′ 0″: Provide drawings as follows:
   1. One wall mounted stick tile for prints.
   2. One set of reproducible drawings.
   3. One complete set of drawings in each electronic forward (AutoCad, and PDF).

E. Maintenance Data and Operating Instructions:
   1. Maintenance and operating manuals in accordance with Section 01010, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
   2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

F. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Conditioning and Refrigeration Institute (ARI):
430-99.....Central Station Air-Handling Units

C. American National Standard Institute (ANSI):
B31.1-2004.....Power Piping

D. Rubber Manufacturers Association (ANSI/RMA):
IP-20-2007.....Drives Using Classical V-Belts and Sheaves
IP-21-1991 (1997).....Drives Using Double-V (Hexagonal) Belts
IP-22-2007.....Drives Using Narrow V-Belts and Sheaves

E. Air Movement and Control Association (AMCA):
410-96.....Recommended Safety Practices for Air Moving devices

F. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code (BPVC):
SEC IX-2007.....Welding and Brazing Qualifications, Welders

G. American Society for Testing and Materials (ASTM):
A36/A36M-2005.....Carbon Structural Steel
A575-96 (2002).....Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)
E84-2003.....Standard Test Method for Burning Characteristics of Building Materials
E119-07.....Standard Test Method for Fire Tests of Building Construction and Materials

H. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
SP-58-2002.....Pipe Hangers and Supports-Materials, Design and Manufacture
SP-69-2003.....Pipe Hangers and Supports-Selection and Application

I. National Association of Plumbing - Heating - Cooling Contractors (NAPHCC):
1996.....National Standard Plumbing Code

J. National Fire Protection Association (NFPA):
90A-02.....Installation of Air Conditioning and Ventilating Systems
101-06.....Life Safety Code

PART 2 - PRODUCTS

2.1 BELT DRIVES

A. Type: ANSI/RMA standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, rating and selection standards: ANSI/RMA IP-20 and IP-21.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take-up.

F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.

G. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:

1. Material: Pressed steel, or close grained cast iron.
2. Bore: Fixed or bushing type for securing to shaft with keys.
3. Balanced: Statically and dynamically.
4. Groove spacing for driving and driven pulleys shall be the same.
5. Minimum Diameter of V-Belt Sheaves (ANSI/RMA recommendations)in millimeters and inches:

Fractional Horsepower		Standard		High Capacity	
Cross Section	Min. od mm (in)	Cross Section	Min. od mm (in)	Cross Section	Min. od mm (in)
2L	20 (0.8)	A	83 (3.25)	3V	67 (2.65)
3L	38 (1.5)	B	146 (5.75)	4V	180 (7.10)
4L	64 (2.5)	C	239 (9.40)	5V	318 (12.50)
5L	89 (3.5)	D	345 (13.60)		
		E	554 (21.80)		

I. Drive Types, Based on ARI 435:

1. Provide adjustable-pitch or fixed-pitch drive as follows:
   a. Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.
   b. Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.

2. Provide fixed-pitch drives for drives larger than those listed above.
3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

2.2 DRIVE GUARDS

A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.

B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

C. Access for Speed Measurement: 25 mm (One inch) diameter hole at each shaft center.

2.3 ELECTRIC MOTORS

A. Section 230512, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT, specifies the applicable requirements for electric motors. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.

B. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

C. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

D. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 40 degrees centigrade (104 degrees F); minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.

E. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.4 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 250511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 262911, LOW-VOLTAGE MOTOR STARTERS for specifications.

B. The combination of controller and motor shall be provided by the respective air handler, fan or pump manufacturer, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. air

handlers, fans, pumps, shall be product of a single manufacturer.

C. Motors shall be energy efficient type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.

D. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.

2.5 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 099100, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 099100, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.

D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. Plumbing: Provide for all valves (Fixture stops not included).
2. HVAC: Provide for all valves.
3. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm(1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
4. Valve lists: Typed or printed plastic coated card(s), sized 216 mm(8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
5. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each

valve with a color coded thumb tack in ceiling.

2.6 FIRESTOPPING

Section 078400, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 230711, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.

2.7 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

2.8 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: Refer to Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

B. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the National Uniform Seismic Installation Guidelines (NUSIG), most current edition. Submittals based on either the NUSIG guidelines or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. Support of suspended equipment over 227kg (500 pounds) shall be submitted for approval of the Resident Engineer in all cases. See paragraph 2.8.M for lateral force design requirements.

C. Supports for Roof Mounted Items:

1. Equipment: Equipment rails shall be aluminum, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 50 mm by 100 mm (2 by 4) treated wood nailer, 1.3 mm (18 gauge) aluminum counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 280 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
2. Pipe/duct pedestals: Provide a galvanized unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

D. Pipe Supports: Comply with MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 055000, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

E. For Attachment to Concrete Construction:

1. Concrete insert: Type 18, MSS SP-58.
2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.

3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition.

F. For Attachment to Steel Construction: MSS SP-58.
1. Welded attachment: Type 22.
2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.

G. Attachment to Metal Pan or Deck: As required for materials specified in Section 053100, STEEL DECKING.

H. For Attachment to Wood Construction: Wood screws or lag bolts.

I. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

J. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41mm by 41mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.
1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

K. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 230711, HVAC, PLUMBING, AND BOILER PLANT for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
1. General Types (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15. Preinsulate.
   g. U-bolt clamp: Type 24.

h. Copper Tube:
   1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.
   2) For vertical runs use epoxy painted or plastic coated riser clamps.
   3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
   4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

2. HVAC Piping (Other Than General Types):
   a. Medium and low pressure steam:
      1) Provide eye rod or Type 17 eye nut near the upper attachment.
      2) Piping 50 mm (2 inches) and larger: Type 43 roller hanger. For roller hangers requiring seismic bracing provide a Type 1 clevis hanger with Type 41 roller attached by flat side bars.
3. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.

L. Pre-insulated Calcium Silicate Shields:
1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
3. Shield thickness shall match the pipe insulation.
4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
   a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
   b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

M. Seismic Restraint of Piping and Ductwork: Refer to Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Comply with MSS SP-127.

2.9 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.

B. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations are not allowed through beams or ribs. Any deviation from this requirements must receive prior approval of Resident Engineer.

D. Steel Pipe Sleeves: Provide for pipe passing through floors, interior walls, and partitions.

E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

F. Galvanized Steel Sleeves: Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.

G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

H. Sleeve Clearance: Sleeve through floors, walls, and partitions, shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

I. Sealant and Adhesives: Shall be as specified in Section 07920, SEALANTS AND CAULKING.

2.10 SPECIAL TOOLS AND LUBRICANTS

A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: Hardwood or metal, permanently identified for in tended service and mounted, or located, where directed by the Resident Engineer.

D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.11 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Also use where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating

space and access provisions that are shown on the drawings.

C. Protection and Cleaning:
   1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
   2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

D. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 033000, CAST-IN-PLACE CONCRETE.

E. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

F. Install steam piping expansion joints as per manufacturer’s recommendations.

G. Work in Existing Building:
   1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 010000, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
   2. As specified in Section 010000, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
   3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Resident Engineer for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely

necessary for the required installation.

H. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.

I. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel, only with the prior approval of the Resident Engineer.

B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.

D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:

1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Plumbing horizontal and vertical pipe supports, refer to the NAPHCC National Standard Plumbing Code.

3.3 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor after approval for structural integrity by the RE/COTR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating plant, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of plant operation. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VA Medical Center, and Contractor shall follow all directives of the RE or COTR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to RE/COTR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

E. Asbestos Insulation Removal: Conform to Sections 028214 ASBESTOS HAZARD CONTROL ACTIVITIES and 028216 ENGINEERING CONTROL OF ASBESTOS CONTAINING MATERIALS.

3.4 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. Material And Equipment Not To Be Painted Includes:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gauges and thermometers.
   j. Glass.
   k. Name plates.
3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
6. Paint shall withstand the following temperatures without peeling or discoloration:
   a. Boiler stack and breeching -- 65 degrees C (150 degrees F) on insulation jacket surface and 315 degrees C (600 degrees F) on metal surface of stacks and breeching.
   b. Condensate and feedwater -- 38 degrees C (100 degrees F) on insulation jacket surface and 120 degrees C (250 degrees F) on metal pipe surface.

c. Steam -- 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (375 degrees F) on metal pipe surface.

7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.5 IDENTIFICATION SIGNS

A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.6 MOTOR AND DRIVE ALIGNMENT

A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.7 LUBRICATION

Field check and lubricate equipment requiring lubrication prior to initial operation.

3.8 STARTUP AND TEMPORARY OPERATION

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 010000, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.9 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 010000, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

C. When completion of certain work or system occurs at a time when final

control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.10 INSTRUCTIONS TO VA PERSONNEL

Provide in accordance with Article, INSTRUCTIONS, of Section 010000, GENERAL REQUIREMENTS.

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SECTION 23 05 12
GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the furnishing, installation and connection of motors for HVAC and steam generation equipment.

1.2 RELATED WORK:

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one Section of Division 26.

B. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS: Starters, control and protection for motors.

C. Other sections specifying motor driven equipment in Division 23.

1.3 SUBMITTALS:

A. In accordance with Section, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting details, materials, horsepower, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and application data.

D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certification to the Resident Engineer:

1. Certification that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.4 APPLICABLE PUBLICATIONS:

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Electrical Manufacturers Association (NEMA):
MG 1-98.....Motors and Generators

MG 2-01.....Safety Standard and Guide for Selection, Installation and Use of Electric Motors and Generators

C. National Fire Protection Association (NFPA):

70-02.....National Electrical Code (NEC)

PART 2 - PRODUCTS

2.1 MOTORS:

A. For alternating current, fractional and integral horsepower motors, NEMA Publications MG 1 and MG 2 shall apply.

B. Voltage ratings shall be as follows:

1. Single phase:
   a. Motors connected to 120-volt systems: 115 volts.
   b. Motors connected to 208-volt systems: 200 volts.
   c. Motors connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
2. Three phase:
   a. Motors connected to 208-volt systems: 200 volts.
   b. Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.

C. Number of phases shall be as follows:

1. Motors, less than 373 W (1/2 HP): Single phase.
2. Motors, 373 W (1/2 HP) and larger: 3 phase.
3. Exceptions:
   a. Hermetically sealed motors.

D. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

E. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.

F. Motor Enclosures:

1. Shall be the NEMA types shown on the drawings for the motors.
2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

G. Additional requirements for specific motors, as indicated in other sections, shall also apply.

H. Energy-Efficient Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 Watts or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				**Minimum Efficiencies Totally Enclosed Fan-Cooled**			
Rating kW (HP)	**1200 RPM**	**1800 RPM**	**3600 RPM**	**Rating kW (HP)**	**1200 RPM**	**1800 RPM**	**3600 RPM**
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%

I. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

J. Premium efficiency motors shall be provided.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install motors in accordance with manufacturer’s recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2 FIELD TESTS

A. Megger all motors after installation, before start-up. All shall test free from grounds.

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SECTION 23 05 41
NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

Noise criteria, seismic restraints for equipment, vibration tolerance and vibration isolation for HVAC and plumbing work.

1.2 RELATED WORK

A. Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic requirements for non-structural equipment

B. Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION: General mechanical requirements and items, which are common to more than one section of Division 15.

C. Section 232113, HYDRONIC PIPING and SECTION 232213, STEAM AND CONDENSATE HEATING PIPING: Requirements for flexible pipe connectors to reciprocating and rotating mechanical equipment.

D. Section 237300, INDOOR CENTRAL-STATION AIR-HANDLING UNITS: Requirements for optional Air Handling Unit internal vibration isolation.

E. Section 233100, HVAC DUCTS AND CASINGS: requirements for flexible duct connectors, sound attenuators and sound absorbing duct lining.

F. Section 230593, TESTING, ADJUSTING AND BALANCING FOR HVAC: requirements for sound and vibration tests.

1.3 QUALITY ASSURANCE

A. Refer to article, QUALITY ASSURANCE in specification Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Noise Criteria:

1. Noise levels in all 8 octave bands due to equipment and duct systems shall not exceed following NC levels:

TYPE OF ROOM	NC LEVEL
Audio Speech Pathology	25
Audio Suites	25
Auditoriums, Theaters	35
Bathrooms and Toilet Rooms	40
Chapels	35
Conference Rooms	35
Corridors (Nurse Stations)	40
Corridors(Public)	40

TYPE OF ROOM	**NC LEVEL**
Dining Rooms, Food Services/ Serving	35
Examination Rooms	35
Gymnasiums	50
Kitchens	50
Laboratories	40
Laundries	50
Lobbies, Waiting Areas	40
Locker Rooms	50
Offices, large open	40
Offices, small private	35
Operating Rooms	40
Patient Rooms	35
Phono/ Cardiology	25
Recreation Rooms	50
Shops	50
SPD	35
Therapeutic Pools	45
Treatment Rooms	35
Warehouse	50
X-Ray & general Work Rooms	40

2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the fore-going noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE Fundamentals Handbook 2001, Chapter 7, Sound and Vibration.
3. An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.

4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

C. Seismic Restraint Requirements:

1. Equipment:
   a. All mechanical equipment not supported with isolators external to the unit shall be securely anchored to the structure. Such mechanical equipment shall be properly supported to resist a horizontal force of 50 percent of the weight of the equipment furnished.
   b. All mechanical equipment mounted on vibration isolators shall be provided with seismic restraints capable of resisting a horizontal force of 100 percent of the weight of the equipment furnished.
2. Piping: Refer to specification Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
3. Ductwork: Refer to specification Section 233100, HVAC DUCTS AND CASINGS.

D. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

1.4 SUBMITTALS

A. Submit in accordance with specification Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Vibration isolators:
   a. Floor mountings
   b. Hangers
   c. Snubbers
   d. Thrust restraints
2. Bases.
3. Seismic restraint provisions and bolting.
4. Acoustical enclosures.

C. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.

D. Seismic Requirements: Submittals are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, standard connections, and manufacturer's certification that all specified equipment will withstand seismic Lateral Force requirements.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
2005.....Fundamentals Handbook 2005, Sound and Vibration, Chapter 7

C. American Society for Testing and Materials (ASTM):
A123/A123M-02.....Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A307-04.....Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
D2240-05.....Standard Test Method for Rubber Property - Durometer Hardness

D. Manufacturers Standardization (MSS):
SP-58-02.....Pipe Hangers and Supports-Materials, Design and Manufacture

E. Occupational Safety and Health Administration (OSHA):
29 CFR 1910.95.....Occupational Noise Exposure.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer but subject to minimum requirements indicated herein and in the schedule on the drawings.

B. Elastometric Isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.

C. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.

D. Color code isolators by type and size for easy identification of capacity.

2.2 SEISMIC RESTRAINT REQUIREMENTS FOR EQUIPMENTS

A. Bolt pad mounted equipment, without vibration isolators, to the floor or other support using ASTM A307 standard bolting material.

B. Floor mounted equipment, with vibration Isolators: Type SS. Where Type N isolators are used provide channel frame base horizontal restraints bolted to the floor, or other support, on all sides of the equipment Size and material required for the base shall be as recommended by the isolator manufacturer.

C. On all sided of suspended equipment, provide bracing for rigid supports and provide restraints for resiliently supported equipment. The slack cable restraint method, Mason Industries, or equal, is acceptable.

2.3 VIBRATION ISOLATORS

A. Floor Mountings:

1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.
2. Spring Isolators (Type S): Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.
3. Captive Spring Mount for Seismic Restraint (Type SS):
   a. Design mounts to resiliently resist seismic forces in all directions. Snubbing shall take place in all modes with adjustment to limit upward, downward, and horizontal travel to a maximum of 6 mm (1/4-inch) before contacting snubbers. Mountings shall have a minimum rating of one G coefficient of gravity as calculated and certified by a registered structural engineer.
   b. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection. Mountings shall have ports for spring inspection. Provide an all directional neoprene cushion collar around the equipment bolt.
4. Spring Isolators with Vertical Limit Stops (Type SP): Similar to spring isolators noted above, except include a vertical limit stop to limit upward travel if weight is removed and also to reduce movement

and spring extension due to wind loads. Provide clearance around restraining bolts to prevent mechanical short circuiting. Isolators shall have a minimum seismic rating of one G.

5. Pads (Type D), Washers (Type W), and Bushings (Type L): Pads shall be felt, cork, neoprene waffle, neoprene and cork sandwich, neoprene and fiberglass, neoprene and steel waffle, or reinforced duck and neoprene. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).
6. Seismic Pad (Type DS): Pads shall be felt, cork neoprene waffle, neoprene and cork sandwich, neoprene and fiberglass, neoprene and steel waffle, or reinforced duck and neoprene, with steel top plate and drilled for an anchor bolt. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).

B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe.

1. Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
2. Spring Position Hanger (Type HP): Similar to combination neoprene and spring hanger except hanger shall hold piping at a fixed elevation during installation and include a secondary adjustment feature to transfer load to spring while maintaining same position.
3. Neoprene (Type HN): Vibration hanger shall contain a double deflection type neoprene isolation element. Hanger rod shall be separated from contact with hanger bracket by a neoprene grommet.
4. Spring (Type HS): Vibration hanger shall contain a coiled steel spring in series with a neoprene grommet. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
5. Hanger supports for piping 50 mm (2 inches) and larger shall have a pointer and scale deflection indicator.

C. Snubbers: Each spring mounted base shall have a minimum of four all-directional or eight two directional (two per side) seismic snubbers that are double acting. Elastomeric materials shall be shock absorbent neoprene bridge quality bearing pads, maximum 60 durometer, replaceable and have a minimum thickness of 6 mm (1/4 inch). Air gap between hard and resilient material shall be not less than 3 mm (1/8 inch) nor more than 6 mm (1/4 inch). Restraints shall be capable of withstanding design load without permanent deformation.

D. Thrust Restraints (Type THR): Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow a maximum movement of 6 mm (1/4 inch) when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

2.4 BASES

A. Rails (Type R): Design rails with isolator brackets to reduce mounting height of equipment and cradle machines having legs or bases that do not require a complete supplementary base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension but not less than 100 mm (4 inches). Where rails are used with neoprene mounts for small fans or close coupled pumps, extend rails to compensate overhang of housing.

B. Integral Structural Steel Base (Type B): Design base with isolator brackets to reduce mounting height of equipment which require a complete supplementary rigid base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension, but not less than 100 mm (four inches).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Vibration Isolation:

1. No metal-to-metal contact will be permitted between fixed and floating parts.
2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports.

3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
4. Provide heat shields where elastomers are subject to temperatures over 38 degrees C (l00 degrees F).
5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.

B. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

3.2 ADJUSTING

A. Adjust vibration isolators after piping systems are filled and equipment is at operating weight.
B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4inch (6-mm) movement during start and stop.
D. Adjust active height of spring isolators.
E. Adjust snubbers according to manufacturer's recommendations.
F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.
G. Torque anchor bolts according to equipment manufacturer's recommendations to resist seismic forces.

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SELECTION GUIDE FOR VIBRATION ISOLATORS

EQUIPMENT		ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
		BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
PUMPS																
CLOSE COUPLED	UP TO 1-/2 HP	---	---	---	---	D,L,W	---	---	D,L,W	---	---	D,L,W	---	---	D,L,W	---
ROOF VENTILTORS																
ABOVE OCCUPIED AREAS:																
5 HP & OVER		---	---	---	CB	S	1.0	CB	S	1.0	CB	S	1.0	CB	S	1.0
CENTRIFUGAL BLOWERS																
UP TO 50 HP:																
UP TO 200 RPM		B	N	0.3	B	S	2.5	B	S	2.5	B	S	3.5	B	S	3.5
201 - 300 RPM		B	N	0.3	B	S	1.7	B	S	2.5	B	S	2.5	B	S	3.5
301 - 500 RPM		B	N	0.3	B	S	1.7	B	S	1.7	B	S	2.5	B	S	3.5
501 RPM & OVER		B	N	0.3	B	S	1.0	B	S	1.0	B	S	1.7	B	S	2.5
AIR HANDLING UNIT PACKAGES																
SUSPENDED:																
UP THRU 5 HP		---	---	---	---	H	1.0	---	H	1.0	---	H	1.0	---	H	1.0
7-1/2 HP & OVER:																
UP TO 500 RPM		---	---	---	---	H,THR	1.7	---	H,THR	1.7	---	H,THR	1.7	---	H,THR	1.7

EQUIPMENT	ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
501 RPM & OVER	---	---	---	---	H,THR	1.0	---	H,THR	1.0	---	H,THR	1.7	---	H,THR	1.7
FLOOR MOUNTED:															
UP THRU 5 HP	---	D	---	---	S	1.0	---	S	1.0	---	S	1.0	---	S	1.0
7-1/2 HP & OVER:															
UP TO 500 RPM	---	D	---	R	S,THR	1.7	R	S,THR	1.7	R	S,THR	1.7	R	S,THR	1.7
501 RPM & OVER	---	D	---	---	S,THR	1.0	---	S,THR	1.0	R	S,THR	1.7	R	S,THR	1.7
IN-LINE CENTRIFUGAL AND VANE AXIAL FANS, FLOOR MOUNTED: (APR 9)															
UP THRU 50 HP:ROOF															
UP TO 300 RPM	---	D	---	R	S	2.5	R	S	2.5	R	S	2.5	R	S	3.5
301 - 500 RPM	---	D	---	R	S	1.7	R	S	1.7	R	S	2.5	R	S	2.5
501 - & OVER	---	D	---	---	S	1.0	---	S	1.0	R	S	1.7	R	S	2.5

NOTES:

1. For suspended floors lighter than 100 mm (4 inch) thick concrete, select deflection requirements from next higher span.
2. Use only SS & DS type isolators and snubbers.
3. Floor mounted (ARR 1): use "B" type in lieu of "R" type base.
4. Suspended: Use "H" isolators of same deflection as floor mounted.

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 REFERENCES

A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) system. TAB includes the following:
   1. Planning systematic TAB procedures.
   2. Design Review Report.
   3. Systems Inspection Report.
   4. Duct Air Leakage test report.
   5. Systems Readiness Report.
   6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
   7. Vibration and sound measurements.
   8. Recording and reporting results.

B. Definitions:
   1. Basic TAB used in this Section: Chapter 36, “Testing, Adjusting and Balancing” of ASHREA Handbook, “HVAC Applications”.
   2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
   3. AABC: Associated Air Balance Council.
   4. NEBB: National Environmental Balancing Bureau.
   5. Hydronic Systems: Includes chilled water and heating hot water.
   6. Air Systems: Includes all outside air, supply air, return air, and exhaust air systems.
   7. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

A. General Mechanical Requirements: Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Noise and Vibration Requirements: Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

C. Piping and Equipment Insulation: Section 230711, HVAC PLUMBING, AND BOILER PLANT INSULATION.

D. Air Handling Unit Performance: 237300, INDOOR CENTRAL-STATION AIR HANDLING UNITS.

E. Terminal Units Performance: Section 233600, AIR TERMINAL UNITS.

F. Duct Leakage: Section 233100, HVAC DUCTS AND CASINGS.

G. Controls and Instrumentation Settings: Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

H. Pumps Performance: Section 232123, HYDRONIC PUMPS.

I. Fans Performance: Section 233400, HVAC FANS.

1.3 QUALITY ASSURANCE

A. Refer to Articles, Quality Assurance and Submittals, in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Qualifications:

1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency’s review shows unsatisfactory work performed by the predecessor agency.
3. TAB Specialist: The TAB Specialist shall be either a member of the AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist

loses its certification prior to Contract completion and must be performed by an approved successor.

4. TAB Specialist Responsibilities:
   a. The General Contractor within 60 days after the notice to proceed shall identify TAB specialist who would be responsible for supervising, coordinating, scheduling and reporting all TAB work and related activities and provide necessary information as required by the Resident Engineer.
   b. All TAB work shall be performed under the direct supervision of the TAB specialist.
   c. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB. The reports shall be signed by the TAB specialist and shall bear the seal of the TAB standard.
   d. The TAB Specialist would follow all TAB work through its satisfactory completion.
   e. Final markings of settings of all HVAC adjustment devices.
   f. Permanently mark location of duct test ports.
5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity of this project and must be certified so by the TAB agency in writing.

C. Test Equipment Criteria: The basic instrumentation requirements and accuracy/calibration required by AABC, National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purposes.

D. TAB Criteria:
1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook “HVAC Applications” chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.
2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook “HVAC Applications”, Chapter 36 as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 90 percent of final values for pre-filters and after-filters.
   a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.

b. Air terminal units (maximum values): Minus 2 percent to plus 10 percent.
c. Exhaust hoods/cabinets: 0 percent to plus 10 percent.
d. Minimum outside air: 0 percent to plus 10 percent.
e. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 2 percent to plus 10 percent except if the air to a space is 100 CEM or less the tolerance would be 0 to plus 5 percent.
f. Heating hot water pumps and hot water coils: Minus 5 percent to plus 5 percent.
g. Chilled water pumps: 0 percent to plus 5 percent.
h. Chilled water coils: 0 percent to plus 5 percent.

3. Systems shall be adjusted for energy efficient operation as described in PART 3.
4. Typical TAB procedures and results shall be demonstrated to the Resident Engineer for one air distribution system (including all fans, three terminal units, three rooms) and one hydronic system (pumps and three coils) as follows:
   a. When field TAB work begins.
   b. During each partial final inspection and the final inspection for the project if requested by VA.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
C. For use by the Resident Engineer staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
D. Submit following for review and approval:
   1. Initial air pressure and air particulate counter reports at commencement of construction, prior to any work performed. Contractor shall submit necessary operational report documentation upon the sole request of COTR. Failure to submit documentation can result in a shutdown of the project at the General Contractor’s expense.
   2. Design Review Report within 60 days after the system layout on air and water side is completed by the Contractor.
   3. Systems inspection report on equipment and installation for conformance with design.

4. Duct Air Leakage Test Report.
5. Systems Readiness Report.
6. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
7. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

1.5 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are reference to by the initials of the organization.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
2003..... HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control.

C. Associated Air Balance Council (AABAC):
2002..... AABC National Standards for Total System Balance

D. National Environmental Balancing Bureau (NEBB):
7th Edition 2005.. Procedural Standards for Testing, Adjusting, Balancing of Environmental systems
1st Edition 1994.. Procedural Standards for the Measurement and Assessment of Sound and Vibration
2nd Edition 1999 .. Procedural Standards for Building Systems Commissioning

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
3rd Edition 2002 .. HVAC Systems-Testing, Adjusting and Balancing

PART 2 - PRODUCTS

2.1 PLUGS

Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

See Section 230711, HVAC, PLUMBING, AND BOILER PLANT INSULATION. Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to TAB Criteria in Article, Quality Assurance.

B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

The TAB Specialist shall review the Contract Plans and specifications and advise the Resident Engineer of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

A. Inspect equipment and installation for conformance with design.

B. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

C. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including flexible duct sizes and routing.

3.4 DUCT AIR LEAKAGE TEST REPORT

See paragraphs "Duct leakage Tests and Repairs" in Section 233100, HVAC DUCTS AND CASINGS for TAB agency’s role and responsibilities in witnessing recording and reporting of deficiencies.

3.5 SYSTEM READINESS REPORT

A. Inspect each System to ensure that it is complete including installation and operation of controls.

B. Verify that all items such as ductwork piping, ports, terminals, connectors etc. required for TAB are installed and provide a report to the Resident Engineer.

3.6 TAB REPORTS

A. Submit an intermediate report for 50 percent of systems and equipment tested and balanced to establish satisfactory test results.

B. The TAB contractor shall provide raw data immediately in writing to the Resident Engineer if there is a problem in achieving intended results before submitting a formal report.

C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval.

D. Do not proceed with the remaining systems until intermediate report is approved by the Resident Engineer.

3.7 TAB PROCEDURES

A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.

B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

C. Coordinate TAB procedures with any phased construction completion requirements for the project. Provide TAB reports for each phase of the project prior to partial final inspections of each phase of the project.

D. Allow sufficient time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.

E. Air Balance and Equipment Test: Include air handling unit, existing air handling unit and exhaust fan located in the existing mechanical penthouse, fans, terminal units, room diffusers/outlets/inlets, and laboratory hoods and cabinets.

1. Artificially load air filters by partial blanking to produce air pressure drop of at least 90 percent of the design final pressure drop.
2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
4. Variable air volume (VAV) systems:
   a. Coordinate TAB, including system volumetric controls, with Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
   b. Section 233600, AIR TERMINAL UNITS, specifies that maximum and

minimum flow rates for air terminal units (ATU) be factory set. Check and readjust ATU flow rates if necessary. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode.

5. Record final measurements for air handling equipment performance data sheets.

F. Water Balance and Equipment Test: Include circulating pumps, convertors, and coils.

1. Adjust flow rates for equipment, coils and evaporator for instance, to values on equipment submittals if different from values on contract drawings.
2. Hot Water Pumps and Existing Chilled Water Pumps Systems: Coordinate tab with Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance system at design water flow.
3. Record final measurements for hydronic equipment performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

3.8 VIBRATION TESTING

A. Furnish instruments and perform vibration measurements as specified in Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Field vibration balancing is specified in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger, including centrifugal/screw compressors, pumps, fans and motors.

B. Record initial measurements for each unit of equipment on test forms and submit a report to the Resident Engineer. Where vibration readings exceed the allowable tolerance Contractor shall correct the problem, the TAB agency shall verify after the corrections are done and submit a final report to the Resident Engineer.

3.9 SOUND TESTING

A. Perform and record required sound measurements in accordance with Paragraph, QUALITY ASSURANCE in Section 230541, NOISE AND VIBRATION

CONTROL FOR HVAC PIPING AND EQUIPMENT.

1. Take readings in rooms, approximately fifteen (15) percent of the total rooms. The Resident Engineer shall designate the specific rooms to be tested.

B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.

C. Sound reference levels, formulae and coefficients shall be according to ASHRAE Handbook, "HVAC Applications", Chapter 46, SOUND AND VIBRATION CONTROL.

D. Determine compliance with specifications as follows:

1. When sound pressure levels are specified, including the NC Criteria in Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
   a. Reduce the background noise as much as possible by shutting off unrelated audible equipment.
   b. Measure octave band sound pressure levels with specified equipment "off."
   c. Measure octave band pressure levels with specified equipment "on."
   d. Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 to 9	10 or More
FACTOR:	10	7	4	3	2	1	0

   Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.
   e. Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.
2. When sound power levels are specified:
   a. Perform steps 1.a. thru 1.d., as above.
   b. For indoor equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.
   c. For outdoor equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be the sum of sound pressure level due to equipment plus the distance factor. Use 10 meters (30 feet) for

sound level location.

3. Where sound pressure levels are specified in terms of dB(A), , measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.

E. Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the Resident Engineer and the necessary sound tests shall be repeated.

3.10 MARKING OF SETTINGS

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Resident Engineer.

3.11 IDENTIFICATION OF TEST PORTS

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

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SECTION 23 07 11
HVAC, PLUMBING, AND BOILER PLANT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for
   1. HVAC piping, ductwork and equipment.

B. Definitions
   1. ASJ: All service jacket, white finish facing or jacket.
   2. Air conditioned space: Space directly supplied with heated or cooled air.
   3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
   4. Concealed: Ductwork and piping above ceilings and in chases, and pipe spaces.
   5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical, Boiler Plant and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, , crawl spaces and pipe basements are not considered finished areas.
   6. FSK: Foil-scrim-kraft facing.
   7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F);HVAC and plumbing equipment or piping handling media above 41 degrees C (105 degrees F); Boiler Plant breechings and stack temperature range 150-370 degrees C(300-700 degrees F) and piping media and equipment 32 to 230 degrees C(90 to 450 degrees F)
   8. Density: Kcm - kilograms per cubic meter (Pcf - pounds per cubic foot).
   9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
   10. Thermal conductance: Heat flow rate through materials.
      a. Flat surface: Watt per square meter (BTU per hour per square foot).
      b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).

11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
12. MPS: Medium pressure steam (110 kPa [16 psig] thru 415 kPa [59 psig].
13. MPR: Medium pressure steam condensate return.
14. LPS: Low pressure steam (103 kPa [15 psig] and below).
15. LPR: Low pressure steam condensate gravity return.
16. HWH: Hot water heating supply.
17. HWHR: Hot water heating return.
18. CH: Chilled water supply.
19. CHR: Chilled water return.
20. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 013323, SHOP DRAWINGS, PRODUCT DATA AND SAMPLE.
B. Section 028214, ASBESTOS HAZARD CONTROL ACTIVITIES: Insulation containing asbestos material.
C. Section 028216, ENGINEERING CONTROL OF ASBESTOS CONTAINING MATERIALS.
D. Section 078400, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
E. Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION: General mechanical requirements and items, which are common to more than one section of Division 15.
F. Section 220523, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.
G. Section 232113, HYDRONIC PIPING AND SECTION 232213, STEAM AND CONDENSATE HEATING PIPING: Piping and equipment.
H. Section 233100, HVAC DUCTS AND CASINGS: Ductwork, plenum and fittings.

1.3 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
B. Criteria:
   1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6 AND 5.4.6.4, parts of which are quoted as follows:
      a. 4.3.3.1 Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesive, fasteners, tapes and supplementary materials added to air ducts, plenums, panels and

duct silencers used in duct systems shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50. Where these products are to be applied with adhesive, they shall be tested with such adhesive applied or the adhesive used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state.

Exception No. 1: This requirement shall not apply to air duct weatherproof coverings where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.

b. Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, Standard for Safety Factory-Made Air Ducts and Air Connectors, shall have been tested and listed in accordance with UL 181A, Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors, or UL 181B, Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors, and used in accordance with the conditions of their listings.

   Exception No. 2: Smoke detectors required by 6.4.4.

c. 4.3.3.3 Air duct, panel and plenum coverings and linings and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe coverings; ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation at the temperature to which they are exposed in service. In no case shall the test temperature be below 250 degrees F (121 degrees C)

d. 4.3.3.4 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating.

   Exception: Where such coverings meet the requirements of 5.4.6.4.

e. 4.3.3.5 Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.

f. 4.3.3.6 Air duct coverings shall not be installed so as to conceal or prevent the use of any service openings.

g. 4.3.10.2.6 Materials exposed to the airflow shall be noncombustible or limited combustible and have a maximum smoke developed index of 50.

h. 5.4.6.4 Where air ducts pass through walls, floors or partitions that are required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall be as follows:
   1) Not exceeding a 2.5 cm (1 inch) average clearance on all sides.
   2) Filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions required for fire barrier penetration as specified in NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials.
      Exception: Where fire dampers are installed, proper clearance for expansion shall be maintained.

2. Test methods: ASTM E84, UL 723, or NFPA 255.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.
5. Listings or Certification from Underwriters Laboratories, Inc., or an equivalent third party testing laboratory will be required to show that surface burning characteristics for materials to continue to adhere to the specified ratings.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:
   1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
      a. Insulation materials: Specify each type used and state surface burning characteristics.
      b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
      c. Insulation accessory materials: Each type used.
      d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
      e. Make reference to applicable specification paragraph numbers for coordination.

1.5 STORAGE AND HANDLING OF MATERIAL

A. Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. Federal Specifications (Fed. Spec.):
   L-P-535E (2)-91.....Plastic Sheet (Sheeting): Plastic Strip; Poly Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

C. Military Specifications (Mil. Spec.):
   MIL-A-3316C (2)-90.....Adhesives, Fire-Resistant, Thermal Insulation
   MIL-A-24179A (1)-87.....Adhesive, Flexible Unicellular-Plastic
   NOTICE 1.....Thermal Insulation
   MIL-C-19565C (1)-88.....Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
   MIL-C-20079H-87.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

D. American Society for Testing and Materials (ASTM):
   A167-99.....Standard Specification for Stainless and

Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B209-04.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-97.....Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-00.....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C533-04.....Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534-05.....Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-06.....Standard Specification for Mineral Fiber pipe Insulation

C552-03.....Standard Specification for Cellular Glass Thermal Insulation

C553-02.....Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C585-90.....Standard practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System) R (1998)

C612-04.....Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-04.....Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-06.....Standard Specification for Flexible, Low Permeance vapor Retarders for Thermal Insulation

D1668-97a (2006).....Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-06.....Standard Test Method for Surface Burning Characteristics of Building Materials

E119-05a.....Standard Test Method for Fire Tests of Building Construction and Materials

E136-99.....Standard Test Methods for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C

(1380 F)

E. National Fire Protection Association (NFPA):

90A-02.....Installation of Air Conditioning and Ventilating Systems

96-04.....Standards for Ventilation Control and Fire Protection of Commercial Cooking Operations

101-06.....Life Safety Code

251-06.....Standard methods of Tests of Fire Endurance of Building Construction Materials

255-06.....Standard Method of tests of Surface Burning Characteristics of Building Materials

F. Underwriters Laboratories, Inc (UL):

723.....UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 08/03.

G. Manufacturer’s Standardization Society of the Value and fitting Industry (MSS):

SP58-2002.....Pipe Hangers and Supports Materials, Design and Manufacture.

PART 2 - PRODUCTS

2.1 MINERAL FIBER

A. ASTM C612 (Board, Block), Class 1 or 2, k = 0.037 Watt per meter, per degree C (0.26), external insulation for temperatures up to 204 degrees C (400 degrees F).

B. ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 16 kcm (1 pcf), k = 0.045 (0.31) Class B-5, Density 32 kcm (2 pcf), k = 0.04 (0.27) , for use at temperatures up to 204 degrees C (400 degrees F)

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) for use at temperatures 230 degrees C (450 degrees F).

2.2 FIRE WRAP DUCT INSULATION

A. Two hour rated single layer flexible enclosure for duct systems.

B. Insulation shall be zero clearance to combustibles at all locations.

C. High temperature, biosoluble insulation with durable foil-scrim covering.

D. Performance:

1. 1.5” thickness.
2. 6 PCF

3. Fire Endurance Rating 150 6944; Stability, Integrity and Insulation: 2 hours.
4. F&T Ratings: 2 hours per ASTM E119 and ASTM E814.
5. ASTM E84/UL723: Flame and Smoke Spread Ratings: 25/50.

E. Approved manufactured Unifrax Fyrewrap or approved equal.

2.3 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance of 0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ).

B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 5 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 100 mm (4 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) jacketing type for concealed ductwork and equipment.

D. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

E. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.

2.4 PIPE COVERING PROTECTION SADDLES

A. Cold pipe support: Premolded pipe insulation 80 degrees C (180 degrees) (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kcm (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long

B. Hot pipe supports: Premolded pipe insulation 80 degrees C (180 degrees F) (half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures upto 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kcm (3.0 pcf).

2.5 ADHESIVE, MASTIC, CEMENT

A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
G. Other: Insulation manufacturers' published recommendations.

2.6 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins, or metal or nylon anchors with tin-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
B. Staples: Outward clinching monel or stainless steel.
C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
D. Bands: 20 mm (3/4 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.7 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.

C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching, vapor barrier, pressure sensitive tape.

2.8 FIRESTOPPING MATERIAL

A. Other than pipe and duct insulation, refer to Section 078400 FIRESTOPPING.

2.9 FLAME AND SMOKE

A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.

C. Where removal of insulation of piping, ductwork and equipment is required to comply with Section 028211, TRADITIONAL ASBESTOS ABATEMENT and Section 028213, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.

D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous

through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

F. Construct insulation on parts of equipment such as convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.

G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.

H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

I. HVAC work not to be thermally insulated:
   1. Internally insulated ductwork and air handling units. Omit insulation on relief air ducts (Economizer cycle exhaust air).
   2. Exhaust air ducts and plenums, and ventilation exhaust air shafts.
   3. Equipment: Expansion tanks, flash tanks, hot water pumps.
   4. In hot piping: Flexible connectors, control valves, PRVs, safety valves and discharge vent piping, vacuum breakers, thermostatic vent valves, steam traps 20 mm (3/4 inch) and smaller, exposed piping through floor for convectors and radiators. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.

J. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

K. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the

necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

L. Firestop Pipe and Duct insulation:
   1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 078400, FIRESTOPPING.
   2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
      a. Pipe risers through mechanical room floors
      b. Pipe or duct chase walls and floors
      c. Smoke partitions
      d. Fire partitions

M. Provide metal jackets over insulation as follows:
   1. All piping and ducts exposed to outdoor weather.
   2. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:
   1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
   2. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics containing air handling units and duct work exposed to outdoor weather:
      a. 40 mm (1-1/2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct and afterfilter housing.
      b. 40 mm (1-1/2 inch) thick insulation faced with ASJ: Return air duct, mixed air plenums and prefilter housing.
      c. Outdoor air ducts: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
   3. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
      a. Convertors, air separators.
      b. Duct mounted hot water reheat coils.

B. Flexible Mineral Fiber Blanket:
   1. Adhere insulation to metal with 100 mm (4 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
   2. Supply air ductwork to be insulated includes main and branch ducts from fan discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
   3. Concealed supply air ductwork.
      a. Above ceilings at a roof level: 50 mm (2 inch) thick insulation faced with FSK.
      b. Above ceilings for other than roof level: 40 mm (1 ½ inch) thick insulation faced with FSK.
   4. Concealed return air duct above ceilings at a roof level and in chases with external wall or containing steam piping; 40 mm (1-1/2 inch) thick, insulation faced with FSK. Concealed return air ductwork in other locations need not be insulated.
   5. Return air duct in interstitial spaces: 40 mm (1-1/2 inch thick insulation faced with FSK.
   6. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.

C. Molded Mineral Fiber Pipe and Tubing Covering:
   1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports.
   2. Nominal thickness in millimeters and inches specified in table below, for piping above ground:

Nominal Thickness of Insulation				
Nominal Pipe Size, millimeters (inches):	25 (1) & below	32- 75 (1-1/4-3)	100-150 (4-6)	200 (8) and above
a. 122-177 degrees C (251-350 F) (MPS)	50 (2.0)	65 (2.5)	90 (3.5)	90 (3.5)
b. 100-121 degrees C MPR (212-250 degrees F) (LPS)	25 (1.0)	50 (2.0)	50 (2.0)	50 (2.0)
c. 38-99 degrees C (100-211 degrees F) (LPR, HWH, HWHR)	25 (1.0)	40 (1.5)	50 (2.0)	50 (2.0)
1. Runouts to reheat coils air terminal unit reheat coils	15 (0.5)	-	-	-

3. Condensation control insulation: Minimum 20 mm (0.75 inch) thick for all pipe sizes.
   a. HVAC: Cooling coil condensation piping to waste piping fixture or drain inlet.

D. Cellular Glass Insulation:
   1. Pipe and tubing, covering nominal thickness in millimeters and inches as tabulated below for chilled water and refrigerant piping.

Nominal Thickness of Insulation				
Millimeters (inches)	Thru 38 (11/2)	50- 150 (2-6)	200-300 (8-12)	over 350 (14)
1. 4-16 degrees C (40-60 degrees F) (CH and CHR outside chiller room)	40 (1.5)	50 (2.0)	50 (2.0)	65 (2.5)

3.3 APPLICATION –BOILER PLANT, PIPE, VALVES, STRAINERS AND FITTINGS:

A. Temperature range 100 to 121 degrees C (211 to 250 degrees F):
   1. Application: Steam service 103 kpa (15 psig) and below, trap assembly discharge piping,
   2. Mineral fiber insulation.
   3. Thickness mineral fiber insulation:

Nominal Thickness Of Insulation	
Pipe Diameter mm (in)	Insulation Thickness mm (in)
25 (1) and below	25 (1)
32 to 80 (1-1/4 to 3)	50 (2)
100 (4) and above	50 (2)

B. Temperature range 32 to 99 degrees C (90 to 211 degrees F):
   1. Application: Pumped condensate, gravity and pumped heating returns, condensate transfer, condensate return from convertors.
   2. Insulation Jacket:
      a. Mineral fiber insulation.
      b. ASJ with PVC premolded fitting coverings.
   3. Thickness mineral fiber insulation:

Nominal Thickness Of Insulation	
Pipe Diameter mm (in)	Insulation Thickness mm (in)
25 (1) and below	25 (1)
32 to 80 (1-1/4 to 3)	38 (1-1/2)
100 (40 and above	50 (2)

C. Installation:
   1. At pipe supports, weld pipe covering protection saddles to pipe, except where MS-SP58, type 3 pipe clamps are utilized.
   2. Insulation shall be firmly applied, joints butted tightly, mechanically fastened by stainless steel wires on 300 mm (12 inch) centers.
   3. At support points, fill and thoroughly pack space between pipe covering protective saddle bearing area.
   4. Terminate insulation and jacket hard and tight at anchor points.
   5. Terminate insulation at piping facilities not insulated wit a 45 degree chamfered section of insulating and finishing cement covered with jacket.
   6. On mineral fiber systems, insulated flanged fittings, strainers and valves with sections of pipe insulation cut, fitted and arranged neatly and firmly wired in place. Fill all cracks, voids and coat outer surface with insulating cement. Install jacket.
   7. On mineral fiber systems, insulate welded and threaded fittings more

than 50 mm (2 inches) in diameter with compressed blanket insulation (minimum 2/1) and finish with jacket or PVC cover.

8. Insulate fittings 50 mm (2 inches) and smaller with mastic finishing material and cover with jacket.
9. Insulate valve bonnet upto valve side of bonnet flange to permit bonnet flange removal without disturbing insulation.
10. Install jacket smooth, tight and neatly finish all edges. Over wrap ASJ butt strips by 50 percent. Secure aluminum jacket with stainless steel bands 300 mm (12 inches) on center or aluminum screws on 200 mm (4 inch) centers.
11. Do not insulate basket removal flanges on strainers.

- - - E N D - - -

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 – GENERAL

1.1 DESCRIPTION

A. The control system(s) shall be an extension of the existing Johnson Control Metasys System as indicated in the project documents and specifications. This scope of work shall include a complete and working system including all engineering, programming, controls and installation materials, installation labor, commissioning and start-up, training, final project documentation and warranty.

B. All control work shall be performed by Johnson Controls, Inc. Windsor, CT 06095 without exception. Failure to use specified manufacturer for products and installation will result in any and all rework performed at the contractor’s expense including labor and materials.

C. The Controls Contractor’s work shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, commissioning, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and items required by the Contract for the complete and fully functional Controls Systems.

D. Following control devices and systems shall be used to provide the functional requirements of HVAC equipment and systems.

1. Direct Digital Control (DDC) of HVAC equipment and systems with electric positioning of valves and dampers.
2. Controls for terminal units including VAV/CAV Boxes and similar units for control of room environment conditions shall be furnished by the Controls Contractor and installed by VAV/CAV box manufacturer.

E. Connect the new work to the existing ECC system or operator workstation. The existing CPU/CRT, printer, and other peripherals may be used to form a single operator workstation. New system including interface to existing systems and equipment shall operate and function as one complete system including one database of control point objects and global control logic capabilities. Facility operators shall have complete operations and control capability over all systems, new and

existing including; monitoring, trending, graphing, scheduling, alarm management, global point sharing, global strategy deployment, graphical operations interface and custom reporting as specified. Modify the existing ECC hardware and software, to accommodate the additional control points.

F. The control subcontractor shall supply as required, the necessary equipment to interface between any existing and new system Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices, hardware and software points provided. Network area controllers are same as remote controller units (RCU).

G. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. Temperature Controls contractor shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the ECC shall have no effect on the field controllers, including those involved with global strategies.

H. The Top End of the NAC shall communicate using American Society of Heating and Refrigerating Engineers/American National Standards Institute (ASHRAE/ANSI) Standard 135(BACnet) protocol. The NAC shall reside on the BACnet/IP Ethernet (ISO 8802-3) local area network, and provide information via standard BACnet object types and application services. The Bottom End of the NAC, the unit level controllers and all other field devices shall reside on the LonTalk FTT-10a network, and provide data using LonMark standard network variable types and configuration properties.

I. The intent of this specification is to provide a peer-to peer networked, stand-alone, distributed control system. The ECC requires the incorporation of LonWorks Technologies using Free Topology Transceivers (FTT-10), and specific conformance to the LONMARK Interoperability Association’s v3.0 Physical and logical Layer guidelines in all (NAC) Network Area Controllers, Remote Control Unit controllers, unitary terminal unit controllers and other LonMark compliant field devices. The minimum Baud rate shall be 78,000 Baud for FTT-10 and 1,250,000 Baud for FTT-1250.

   1. LonTalk communications protocol will be used on the communication network between RCU controllers and LonWorks controllers and devices to assure interoperability between all devices within the network.

2. The ECC shall provide communication to all LonTalk data variables as defined in input/output point schedule and as required to accomplish sequence of operation as specified.
3. Power wiring shall not be run in conduit with communications trunk wiring.

J. The control system shall accommodate simultaneously multiple user operation (10 to 20 users) and the access to the system should be limited only by operator password.

1.2 RELATED WORK

A. Section 283100, FIRE DETECTION AND ALARM.
B. Section 232213, STEAM AND CONDENSATE HEATING PIPING.
C. Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
D. Section 233400, HVAC FANS.
E. Section 232113, HYDRONIC PIPING.
F. Section 233600, AIR TERMINAL UNITS
G. Section 237300, INDOOR CENTRAL-STATION AIR HANDLING UNITS.
H. Section 233100, HVAC DUCTS AND CASINGS.
I. Section 232113, HYDRONIC PUMPS.
J. Section 234000, HVAC AIR CLEANING DEVICES.
K. Section 230593, TESTING, ADJUSTING AND BALANCING FOR HVAC.
L. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
M. Section 260533, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
N. Section 260521, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BEL0W).
O. Section 262726, WIRING DEVICES.

1.3 DEFINITION

A. Algorithm: A logical procedure for solving a recurrent mathematical problem; a prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.
B. ACU: Auxiliary Control Unit (ACU) used for controls of air handling units, reports to RCU.
C. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc.)
D. BACnet: Building Automation Control Network Protocol, ASHRAE Standard 135.
E. Baud: It is a signal change in a communication link. One signal change can represent one or more bits of information depending on type of transmission scheme. Simple peripheral communication is normally one bit per Baud. (e.g., Baud rate = 78,000 Baud/sec is 78,000 bits/sec, if one

signal change = 1 bit).

F. Binary: A two-state system where a high signal level represents an "ON" condition and an "OFF" condition is represented by a low signal level.

G. BMP or bmp: Suffix, computerized image file, used after the period in a DOS-based computer file to show that the file is an image stored as a series of pixels.

H. Bus Topology: A network topology that physically interconnects workstations and network devices in parallel on a network segment.

I. Control Unit (CU): Generic term for any controlling unit, stand-alone, microprocessor based, digital controller residing on secondary LAN or Primary LAN, used for local controls or global controls. In this specification, there are three types of control units are used; Unitary Control Unit (UCU), Auxiliary Control Unit (ACU), and Remote Control Unit (RCU).

J. Deadband: A temperature range over which no heating or cooling is supplied, i.e., 22-25 degrees C (72-78 degrees F), as opposed to a single point change over or overlap).

K. Diagnostic Program: A software test program, which is used to detect and report system or peripheral malfunctions and failures. Generally, this system is performed at the initial startup of the system.

L. Direct Digital Control (DDC): Microprocessor based control including Analog/Digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices in order to achieve a set of predefined conditions.

M. Distributed Control System: A system in which the processing of system data is decentralized and control decisions can and are made at the subsystem level. System operational programs and information are provided to the remote subsystems and status is reported back to the Engineering Control Center. Upon the loss of communication with the Engineering Control center, the subsystems shall be capable of operating in a stand-alone mode using the last best available data.

N. Download: The electronic transfer of programs and data files from a central computer or operation workstation with secondary memory devices to remote computers in a network (distributed) system.

O. DXF: An AutoCAD 2-D graphics file format. Many CAD systems import and export the DXF format for graphics interchange.

P. Electrical Control: A control circuit that operates on line or low

voltage and uses a mechanical means, such as a temperature sensitive bimetal or bellows, to perform control functions, such as actuating a switch or positioning a potentiometer.

Q. Electronic Control: A control circuit that operates on low voltage and uses a solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator.

R. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.

S. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

T. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.

U. FTT-10: Echelon Transmitter-Free Topology Transceiver.

V. GIF: Abbreviation of Graphic interchange format.

W. Graphic Program (GP): Program used to produce images of air handler systems, fans, chillers, pumps, and building spaces. These images can be animated and/or color-coded to indicate operation of the equipment.

X. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.

Y. I/O Unit: The section of a digital control system through which information is received and transmitted. I/O refers to analog input (AI, digital input (DI), analog output (AO) and digital output (DO). Analog signals are continuous and represent temperature, pressure, flow rate etc, whereas digital signals convert electronic signals to digital pulses (values), represent motor status, filter status, on-off equipment etc.

Z. I/P: Internet Protocol-global network, connecting workstations and other host computers, servers etc. to share the information.

AA. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.

BB. Local Area Network (LAN): A communication bus that interconnects operator workstation and digital controllers for peer-to-peer communications, sharing resources and exchanging information.

CC. LonMark: An association comprising of suppliers and installers of LonTalk products. The Association provides guidelines for the

implementation of the LonTalk protocol to ensure interoperability through Standard implementation.

DD. LonTalk: An open standard protocol developed by the Echelon Corporation that uses a “Neuron Chip” for communication.

EE. LonWorks: Network technology developed by the Echelon Corporation.

FF. Network: A set of computers or other digital devices communicating with each other over a medium such as wire, coax, fiber optics cable etc.

GG. Network Area Controller: Digital controller, supports a family of auxiliary control units and unitary control units, and communicates with peer-to-peer network for transmission of global data.

HH. Network Repeater: A device that receives data packet from one network and rebroadcasts to another network. No routing information is added to the protocol.

II. MS/TP: Master-slave/token-passing.

JJ. Operating system (OS): Software, which controls the execution of computer application programs.

KK. PCX: File type for an image file. When photographs are scanned onto a personal computer they can be saved as PCX files and viewed or changed by a special application program as Photo Shop.

LL. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor, printer, and I/O unit.

MM. Peer-to-Peer: A networking architecture that treats all network stations as equal partners.

NN. PICS: Protocol Implementation Conformance Statement.

OO. UCU: Unitary Control Unit, digital controller, dedicated to a specific piece of equipment, such as VAV boxes, chillers, fan coil units, heat exchangers etc.

1.4 QUALITY ASSURANCE

A. Criteria:

1. The Controls and Instrumentation System Contractor shall be Johnson Controls, Inc. located in Windsor, CT. Distributors, manufacturer’s representatives and wholesalers will not be acceptable.
2. Single Source Responsibility of subcontractor: The Contractor shall obtain hardware and software supplied under this Section and delegates the responsibility to a single source controls installation subcontractor. The controls subcontractor shall be responsible for the complete design, installation, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems

similar in size and complexity.

3. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer’s latest standard design and have been tested and proven in actual use.
4. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor.

B. Codes and Standards:
1. All work shall conform to the applicable Codes and Standards.
2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.
3. Peer-to-peer controllers, unitary controllers shall confirm to the requirements of UL 916, Category PAZX.

1.5 PERFORMANCE

A. The system shall conform to the following:
1. Graphic Display: The system shall display up to 4 graphics on a single screen with a minimum of (20) dynamic points per graphic. All current data shall be displayed within (10) seconds of the request.
2. Graphic Refresh: The system shall update all dynamic points with current data within (10) seconds. Data refresh shall be automatic, without operator intervention.
3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be (10) seconds. Analog objects shall start to adjust within (3) seconds.
4. Object Scan: All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or work-station will be current, within the prior (10) seconds.
5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed (10) seconds.
6. Program Execution Frequency: Custom and standard applications shall

be capable of running as often as once every (5) seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

7. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every five (5) seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
8. Multiple Alarm Annunciations: All workstations on the network shall receive alarms within (5) seconds of each other.
9. Reporting Accuracy: Listed below are minimum acceptable reporting accuracies for all values reported by the specified system:

Measured Variable	**Reported Accuracy**
Space temperature	±0.5 degrees C (±1 degrees F)
Ducted air temperature	±1.0 degrees C [±2 degrees F]
Outdoor air temperature	±1.0 degrees C [±2 degrees F]
Water temperature	±0.5 degrees C [±1 degrees F]
Relative humidity	±2 percent RH
Air flow (terminal)	±10 percent of reading
Air flow (measuring stations)	±5 percent of reading
Air pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air pressure (space)	±3 Pa [±0.001 "W.G.]
Water pressure	±2 percent of full scale *Note 1

Note 1: for both absolute and differential pressure

1.6 WARRANTY

A. Labor and materials for control systems shall be warranted for a period as specified under Warranty in FAR Clause 52.246-21.

B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the owner. The system includes all computer equipment, transmission equipment, and all sensors and control devices.

C. The on-line support service shall allow the Controls supplier to dial out over telephone lines to monitor and control the facility’s building automation system. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported. This

coverage shall be extended to include normal business hours, after business hours, weekend and holidays. If the problem cannot be resolved with on-line support services, the Controls supplier shall dispatch the qualified personnel to the job site to resolve the problem within 24 hours after the problem is reported.

D. Controls and Instrumentation subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by VA.

1.7 SUBMITTALS

A. Submit shop drawings in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer’s literature and data for all components including the following:

1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to, control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.
2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
3. Control dampers and control valves schedule, including the size and pressure drop.
4. Installation instructions for smoke dampers and combination smoke/fire dampers, if furnished.
5. Catalog cut sheets of all equipment used. This includes, but is not limited to DDC controllers, panels, peripherals, airflow measuring stations and associated components, and auxiliary control devices such as sensors, actuators, and control dampers. When manufacturer’s cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted. Each submitted piece of literature and drawings should clearly reference the specification and/or drawings that it supposed to represent.
6. Sequence of operations for each HVAC system and the associated

control diagrams. Equipment and control labels shall correspond to those shown on the drawings.

7. Color prints of proposed graphics with a list of points for display.
8. Furnish PICS for each BACNET compliant device.

C. Product Certificates: Compliance with Article, QUALITY ASSURANCE.

D. As Built Control Drawings:

1. Furnish three (3) copies of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.
2. Furnish one (1) stick set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
3. Furnish one (1) CD-ROM in CAD DWG and ONE CD ROM in PDF format for the drawings noted in subparagraphs above.

E. Operation and Maintenance (O/M) Manuals):

1. Submit in accordance with Article, INSTRUCTIONS, in Specification Section 010000, GENERAL REQUIREMENTS.
2. Include the following documentation:
   a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.
   b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
   c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software.
   d. Complete troubleshooting procedures and guidelines for all systems.
   e. Complete operating instructions for all systems.
   f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.
   g. Licenses, guaranty, and other pertaining documents for all equipment and systems.
   h. Training Manuals: Submit the course outline and training material to the Owner for approval three (3) weeks prior to the training to

VA facility personnel. These persons will be responsible for maintaining and the operation of the control systems, including programming. The Owner reserves the right to modify any or all of the course outline and training material.

F. Submit Performance Report to Resident Engineer prior to final inspection.

1.8 INSTRUCTIONS

A. Instructions to VA operations personnel: Perform in accordance with Article, INSTRUCTIONS, in Specification Section 010000, GENERAL REQUIREMENTS, and as noted below. Contractor shall also video tape instruction sessions noted below.

1. First Phase: Formal instructions to the VA facilities personnel for a total of 16 hours, conducted sometime between the completed installation and prior to the performance test period of the control system, at a time mutually agreeable to the Contractor and the VA.
2. Second Phase: This phase of training shall comprise of on the job training during start-up, checkout period, and performance test period. VA facilities personnel will work with the Contractor’s installation and test personnel on a daily basis during start-up and checkout period. During the performance test period, controls subcontractor will provide 16 hours of instructions to the VA facilities personnel.
3. The O/M Manuals shall contain approved submittals as outlined in Article 1.7, SUBMITTALS. The Controls subcontractor will review the manual contents with VA facilities personnel during second phase of training.
4. Training by independent or franchised dealers who are not direct employees of the controls supplier will not be acceptable.

1.9 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

A. The ECC and peripheral devices and system support equipment shall be designed to operate in ambient condition of 20 to 35 degrees C (65 to 90 degrees F) at a relative humidity of 20 to 80 percent non-condensing.

B. The CUs and associated equipment used in controlled environment shall be mounted in NEMA 1 enclosures for operation at 0 to 50 degrees C (32 to 122 degrees F) at a relative humidity of 10 to 90 percent non-condensing.

C. The CUs used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at –40 to 65 degrees C (-40 to 150 degrees F).

D. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.

E. Sensors and controlling devices shall be designed to operate in the environment, which they are sensing or controlling.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
135-04.....BACNET Building Automation and Control Networks

C. American Society of Mechanical Engineers (ASME):
B16.18-01.....Cast Copper Alloy Solder Joint Pressure Fittings.
B16.22-01.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

D. American Society of Testing Materials (ASTM):
B32-04.....Standard Specification for Solder Metal
B88-03.....Standard Specifications for Seamless Copper Tube
B88M-05.....Standard Specification for Seamless Copper Tube (Metric)
B280-03.....Standard Specification for Seamless Copper Tube for Air-Conditioning and Refrigeration Field Service
D2737-03.....Standard Specification for Polyethylene Tube

E. Federal Communication Commission (FCC):
Rules and Regulations Title 47 Chapter 1-2001 Part 15 Radio Frequency Devices.

F. Institute of Electrical and Electronic Engineers (IEEE):
802.3-05.....Information Technology-Telecommunications and Information Exchange between Systems-Local and Metropolitan Area Networks- Specific Requirements-Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

G. Instrument Society of America (ISA):
7.0.01-1996.....Quality Standard for Instrument Air

H. National Fire Protection Association (NFPA):
70-05.....National Electric Code

90A-02.....Standard for Installation of Air-Conditioning and Ventilation Systems

I. Underwriter Laboratories Inc (UL):

94-06.....Test for Flammability of Parts and Devices and Appliances

294-05.....Access Control System Units

486A/486B-04.....Wire Connectors

555S-03.....Leakage Ratings for Dampers for Use in Smoke Control Systems

916 Rev 2-04.....Energy Management

1076-05.....Proprietary Burglar Alarm Units and Systems

PART 2 – PRODUCTS

2.1 CONTROLS SYSTEM ARCHITECTURE

A. General:

1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.
2. The Operator Workstations, Servers and principal network computer equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels – not "Clones" assembled by a third-party subcontractor.
3. Provide licenses for all software residing on and used by the Controls Systems and transfer these licenses to the Owner prior to completion.
4. The networks shall, at minimum, comprise, as necessary, the following:
   a. Network computer processing, data storage and communication equipment including Servers and digital data processors.
   b. Routers, bridges, switches, hubs, modems, interfaces and the like communication equipment.
   c. Active processing network area controllers connected to programmable field panels and controllers together with their power supplies and associated equipment.
   d. Addressable elements, sensors, transducers and end devices.
   e. Third-party equipment interfaces as required by the Contract Documents.
   f. Other components required for a complete and working Control Systems as specified.

B. The Specifications for the individual elements and component subsystems

shall be minimum requirements and shall be augmented as necessary by the Contractor to achieve both compliance with all applicable codes, standards and to meet all requirements of the Contract Documents.

C. Network Architecture
   1. The Controls Systems Application network shall utilize an open architecture capable of each and all of the following:
      a. Utilizing standard Ethernet communications and operate at a minimum speed of 10/100 Mb/sec.
      b. Connecting via BACNET with ANSI/ASHRAE Standard 135.
      c. LonMark as per ANSI/EIA 709 (LonWorks) to LonMark FTT-10 transceivers.
   2. The networks shall utilize only copper and optical fiber communication media as appropriate and to comply with the applicable codes, ordinances and regulations.
   3. All necessary telephone lines, ISDN lines and internet Service Provider services and connections will be provided by the owner.

2.2 DIRECT DIGITAL CONTROLLERS

A. (NAC) Network Area Controllers shall be stand-alone, multi-tasking, multi-user, real-time digital processor complete with all hardware, software, and communications interfaces, power supplies. The Controls System shall be designed and implemented entirely for use and operation on the Internet. NACs shall have access to data within the industry standard IT network to the Data Server and other NACs as needed to accomplish required global control strategies.
   1. NACs shall provide both standalone and networked direct digital control of mechanical and electrical building system controllers as required by the Specifications. The primary NAC shall support a minimum of [5,000] field points together with all associated features, sequences, schedules, applications required for a fully functional distributed processing operation.
   2. NACs shall monitor and report communication status to the Controls Systems Application. The Controls Systems shall provide a system advisory upon communication failure and restoration.
   3. All NACs on the network shall be equipped with all software functionality necessary to operate the complete user interface, including graphics, via a Browser connected to the Node on the network or directly via a local port on the NAC.
   4. All NAC shall be provided with face mounted LED type annunciation to continually display its operational mode, power and communications.

5. The controllers shall reside on the BACnet Ethernet (ISO 8802-3) local area network and provide Read (Initiate) and Write (Execute) services as defined in Clauses 15.5 and 15.8, respectively of ASHRAE Standard 135, to communicate BACnet objects. Objects supported shall include: Analog input, analog output, analog value, binary input, binary output, binary value, and device.
6. Each NAC shall be provided with the necessary un-interruptible power facilities to ensure its continued normal operation during periods of line power outages of, at minimum, 1-minute duration. Normal functionality shall include all normal software processing, communication with powered field devices and network communications with other powered Controls Systems NAC, Data Servers and OWS. Each NAC shall report its communication status to the Application. The Application shall provide a system advisory upon communication failure and restoration. Each NAC shall retain program, control algorithms, and setpoint information in non-volatile memory in the event of a power failure, and shall return to normal operation upon restoration of power.
7. Each NAC shall have sufficient memory to support its operating system, database, and program requirements, including the following:
   a. Device and network management.
   b. Data sharing.
   c. Alarm and event management including custom alarm messages for each level alarm for the points noted in the I/O Schedule.
   d. Energy management.
   e. Historical trend data for points specified.
   f. Maintenance report.
   g. Scheduling.
   h. Dial up and network communications.
   i. Manual override monitoring.
8. Each NAC shall support firmware upgrades without the need to replace hardware and shall have a minimum of 15 percent spare capacity of secondary system controllers, point capacity and programming functions.
9. Each NAC shall continuously perform self-diagnostics, communication diagnosis, and provide both local and remote annunciation of any detected component failures, low battery condition; and upon failure shall assume the predetermined failure mode.
10. Each NAC shall monitor the status of all overrides and inform the

operator that automatic control has inhibited, and allow the operator to manually override automatic or centrally executed command.

11. Provide the capability to generate and modify the Controls Systems Application software-based sequences, database elements, associated operational definition information and user-required revisions to same at any designated Workstation together with the means to download same to the associated System Controllers.
12. In the event of loss of normal power, there shall be orderly shut down of the controllers to prevent the loss of database or software programming. When power is restored flash memory, battery backup or super capacitor will be automatically loaded into non-volatile flash memory and shall be incorporated for all programming data.

B. Auxiliary Control Units (ACUs) shall be stand-alone, multi-tasking, multi-user, real time digital processor complete with all hardware, software and communication interfaces, power supplies, and input/output modular devices.

1. ACUs shall either reside on the LonTalk FTT-10a network or provide data using LonMark standard network variable types and configuration properties.
2. All ACUs shall be provided with LED type annunciation to continually display its operational mode, power and communications.
3. Each ACU shall have sufficient memory to support its operating system, database including the following:
   a. Data sharing.
   b. Device and network management.
   c. Alarm and event management.
   d. Scheduling.
   e. Energy Management.
4. Each ACU shall support firmware upgrades without the need to replace hardware and shall have a minimum of 15 percent spare capacity of I/O functions. The type of spares shall be in the same proportion as the implemented functions on the controller, but in no case there shall be less than one point of each implemented I/O type.
5. Each ACU shall continuously perform self-diagnostics, communication diagnosis, and provide both local and remote annunciation of any detected component failures, low battery condition; and upon failure shall assume the predetermined failure mode.
6. In the event of loss of normal power, there shall be orderly shut down of the controllers to prevent the loss of database or software

programming. When power is restored flash memory, battery backup or super capacitor will be automatically loaded into non-volatile flash memory and shall be incorporated for all programming data.

C. Unitary Control Units (UCUs) shall be capable of stand-alone, microprocessor-based and shall continue to provide control functions.
   1. Unitary Control Units shall either reside on the LonTalk FTT-10a network or provide data using LonMark standard network variable types and configuration properties.
   2. Each UCU shall have sufficient memory to support its own operating system, including data sharing.
   3. All UCUs shall be provided with LED type annunciation to continually display its operational mode, power and communications.
   4. In the event of loss of normal power, there shall be orderly shut down of the controllers to prevent the loss of database or software programming. When power is restored flash memory, battery backup or super capacitor will be automatically loaded into non-volatile flash memory and shall be incorporated for all programming data.

D. Provide I/O module that connects sensors and actuators onto the field bus network for use by the direct digital controllers. I/O devices shall support the communication technology specified for each controller.
   1. Analog input shall allow the monitoring of low voltage (0-10 VDC), current (4-20 ma), or resistance signals (thermistor, RTD). Analog input shall be compatible with, and field configurable to commonly available sensing devices. Analog output shall provide a modulating signal for these control devices.
   2. Binary inputs shall allow the monitoring of on/off signals from remote devices. Binary inputs shall provide a wetting current of at least 12 milliamps to be compatible with commonly available control devices. Binary outputs shall provide on/off operation, or a pulsed low voltage signal for pulse width modulation control. Outputs shall be selectable for either normally open or normally closed operation.
   3. Binary outputs on remote and auxiliary controllers shall have 3-position (on/off/auto) override switches and status lights. Analog outputs on remote and auxiliary controllers shall have status lights and a 2-position (auto/manual) switch and manually adjustable potentiometer for manual override.
   4. Each output point shall be provided with a light emitting diode (LED) to indicate status of outputs.

E. Communication Ports:
   1. NACs controllers in the DDC systems shall be connected in a system local area network using protocol defined by ASHRAE Standard 135, BACnet protocol.
   2. The control supplier shall provide connectors, repeaters, hubs, and routers necessary for inter-network communication.
   3. Minimum baud rate between the peer-to-peer controllers in the system LAN shall be maintained at the rate of 10 Mbps. Minimum baud for the low level controllers between UCUs and ACUs, ACUs and NAC’s shall be maintained at the rate of 76 Kbps.
   4. Provide RS-232 port with DB-9 or RJ-11 connector for communication with each controller that will allow direct connection of standard printers, operator terminals, modems, and portable laptop operator’s terminal. Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.
   5. Database, such as points; status information, reports, system software, custom programs of any one controller shall be readable by any other controller on the network.

F. Electric Outlet: Provide a single phase, 120 VAC electrical receptacles inside or within 2 meters (6 feet) of the NAC and ACU enclosures for use with test equipment.

G. Spare Equipment:
   1. Provide ten (10) percent spare digital controller (CU) boards and ten (10) percent I/O boards. It shall be possible for trained hospital personnel to replace CU boards and load software.
   2. Provide a minimum of one spare digital controller board of each type and associated parts including batteries to make at least one complete set of DDC control equipment spares.
   3. If I/O boards are separate from the CU boards, provide two spare I/O boards for each spare CU board provided above.

2.3 DIRECT DIGITAL CONTROLLER SOFTWARE

A. The software programs specified in this section shall be commercially available, concurrent, multi-tasking operating system and support the use of software application that operates under DOS or Microsoft Windows.

B. All points shall be identified by up to 30-character point name and 16-character point descriptor. The same names shall be used at the operator

workstation.

C. All control functions shall execute within the stand-alone control units via DDC algorithms. The VA shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters.

D. All CU’s shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, or by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor-failed message at the ECC workstation. Each ACU and RCU shall have capability for local readouts of all functions. The UCUs shall be read remotely.

E. All DDC control loops shall be able to utilize any of the following control modes:
   1. Two position (on-off, slow-fast) control.
   2. Proportional control.
   3. Proportional plus integral (PI) control.
   4. Proportional plus integral plus derivative (PID) control. All PID programs shall automatically invoke integral wind up prevention routines whenever the controlled unit is off, under manual control of an automation system or time initiated program.
   5. Automatic tuning of control loops.

F. System Security: Operator access shall be secured using individual password and operator’s name. Passwords shall restrict the operator to the level of object, applications, and system functions assigned to him. A minimum of six (6) levels of security for operator access shall be provided.

G. Application Software: The CUs shall provide the following programs as a minimum for the purpose of optimizing energy consumption while maintaining comfortable environment for occupants. All application software shall reside and run in the system digital controllers. Editing of the application shall occur at the operator workstation or via a portable workstation, when it is necessary, to access directly the programmable unit.
   1. The economizer program shall be provided for air handling units.
   2. Night Setback/Morning Warm up Control: The system shall provide the ability to automatically adjust set points for this mode of

operation.

3. Optimum Start/Stop (OSS): Optimum start/stop program shall automatically be coordinated with event scheduling. The OSS program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by the time of occupancy, and it shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period and still maintain desired comfort conditions. The OSS program shall operate on both outside weather conditions as well as inside zone conditions. The program shall automatically assign longer lead times for weekend and holiday shutdowns. Space temperature input is to be the highest value of zones served in the cooling mode and the lowest of zones served in the heating mode. It shall be possible to assign occupancy start times on a per air handler unit basis. The program shall meet the local code requirements for minimum outdoor air while the building is occupied. Modification of assigned occupancy start/stop times shall be possible via operator’s workstation.
4. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or a group of points according to a stored time. This program shall provide the capability to individually command a point or group of points. When points are assigned to one common load group it shall be possible to assign variable time advances/delays between each successive start or stop within that group. Scheduling shall be calendar based and advance schedules may be defined up to one year in advance. Advance schedule shall override the day-to-day schedule. The operator shall be able to define the following information:
   a. Time, day.
   b. Commands such as on, off, auto.
   c. Time delays between successive commands.
   d. Manual overriding of each schedule.
   e. Allow operator intervention.
5. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and events. An alarm shall be able to start programs, login the event, print and display the messages. The system shall allow the operator to prioritize the alarms to minimize nuisance reporting and to speed operator’s response to critical alarms. A minimum of six (6) priority levels of

alarms shall be provided for each point.

6. Remote Communications: The system shall have the ability to communicate over the existing hospital control network and the internet in the event of an alarm to workstations and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system using standard internet software. Remote access shall allow the operator to function the same as local access.
7. Maintenance Management (PM): The program shall monitor equipment status and generate maintenance messages based upon the operators defined equipment run time, starts, and/or calendar date limits. A preventative maintenance alarm shall be printed indicating maintenance requirements based on pre-defined run time. Each preventive message shall include point description, limit criteria and preventative maintenance instruction assigned to that limit. A minimum of 480-character PM shall be provided for each component of units such as air handling units.

2.4. SENSORS (AIR, WATER AND STEAM)

A. Temperature and humidity sensors:

1. Electronic Sensors: Provide all remote sensors as required for the systems. All sensors shall be vibration and corrosion resistant for wall, immersion, and/or duct mounting.
   a. Temperature Sensors: Thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral transmitter type for all other sensors.
      1) Duct sensors shall be rigid or averaging type as shown on drawings. Averaging sensor shall be a minimum of 1 linear ft of sensing element for each sq ft of cooling coil face area.
      2) Immersion sensors shall be provided with a separable well made of stainless steel, bronze or monel material. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
      3) Space sensors shall be equipped with set-point adjustment, override switch, display, and communication port. Match room thermostats, locking cover.
      4) Outdoor air temperature sensors shall have watertight inlet fittings and shielded from direct sunlight.
      5) Room security sensors shall have stainless steel cover plate

with insulated back and security screws.

6) Wire: Twisted, shielded-pair cable.

7) Output Signal: 4-20 ma.

b. Humidity Sensors: Bulk polymer sensing element type.

1) Duct and room sensors shall have a sensing range of 20 to 80 percent with accuracy of ± 2 to ± 5 percent RH, including hysteresis, linearity, and repeatability.

2) Duct and outdoor humidity sensors shall be furnished with element guard and mounting plate and have a sensing range of 0 to 100 percent RH.

3) 4-20 ma continuous output signal.

c. Static Pressure Sensors: Non-directional, temperature compensated.

1) 4-20 ma output signal.

2) 0 to 5 inches wg for duct static pressure range.

3) 0 to 0.25 inch wg for Building static pressure range.

B. Water Flow Sensors:

1. Sensor shall be insertion turbine type with turbine element, retractor and preamplifier/transmitter mounted on a two-inch full port isolation valve; assembly easily removed or installed as a single unit under line pressure through the isolation valve without interference with process flow; calibrated scale shall allow precise positioning of the flow element to the required insertion depth within plus or minute 1 mm (0.05 inch); wetted parts shall be constructed of stainless steel. Operating power shall be nominal 24 VDC. Local instantaneous flow indicator shall be LED type in NEMA 4 enclosure with 3-1/2 digit display, for wall or panel mounting.

2. Performance characteristics:

a. Ambient conditions: -40 to 60 degrees C (-40 to 140 degrees F), 5 to 100 percent humidity.

b. Operating conditions: 850 kPa (125 psig), 0 to 120 degrees C (30 to 250 degrees F), 0.15 to 12 m per second (0.5 to 40 feet per second) velocity.

c. Nominal range (turn down ratio): 10 to 1.

d. Overall accuracy plus or minus one percent of reading.

e. Repeatability: plus or minus 0.25 percent of reading.

f. Preamplifier mounted on meter shall provide 4-20 ma divided pulse output or switch closure signal for units of volume or mass per a time base. Signal transmission distance shall be a minimum of 1,800 meters (6,000 feet).

g. Pressure Loss: Maximum 1 percent of the line pressure in line sizes above 100 mm (4 inches).

h. Ambient temperature effects, less than 0.005 percent calibrated span per degree C (degree F) temperature change.

i) RFI effect - flow meter shall not be affected by RFI.

j) Power supply effect less than 0.02 percent of span for a variation of plus or minus 10 percent power supply.

C. Flow Switches

1. Flow switches shall be either paddle or differential pressure type.

a. Paddle-type switches (liquid service only) shall be UL Listed, SPDT snap-acting, adjustable sensitivity with NEMA 4 enclosure.

b. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap acting, NEMA 4 enclosure, with scale range and differential suitable for specified application.

D. Current Switches: Current operated switches shall be self powered, solid state with adjustable trip current as well as status, power, and relay command status LED indication. The switches shall be selected to match the current of the application and output requirements of the DDC systems.

2.5 CONTROL CABLES

As specified in Division 26.

2.6 THERMOSTATS AND HUMIDISTATS

A. Room thermostats controlling heating and cooling devices shall have three modes of operation (heating - null or dead band - cooling). Wall mounted thermostats shall have polished or brushed aluminum satin chrome manufacturer's recommendation finish, setpoint range and temperature display and external adjustment:

1. Electronic Thermostats: Solid-state, microprocessor based, programmable to daily, weekend, and holiday schedules.

a. Public Space Thermostat: Public space thermostat shall be a platinum sensor and shall not have a visible means of set point adjustment. Adjustment shall be via the digital controller to which it is connected.

b. Offices and Laboratories: Platinum sensor with set point adjustment and an indicator.

c. Battery replacement without program loss.

B. Strap-on thermostats shall be enclosed in a dirt-and-moisture proof housing with fixed temperature switching point and single pole, double throw switch.

C. Freezestats shall have a minimum of 300 mm (one linear foot) of sensing element for each 0.093 square meter (one square foot) of coil area. A freezing condition at any increment of 300 mm (one foot) anywhere along the sensing element shall be sufficient to operate the thermostatic element.

D. Room Humidistats: Provide fully proportioning humidistat with adjustable throttling range for accuracy of settings and conservation. The humidistat shall have set point scales shown in percent of relative humidity located on the instrument. Systems showing moist/dry or high/low are not acceptable.

E. Mercury-filled thermometers will not be acceptable.

2.7 SPECIAL CONTROLLERS

A. Laboratory rooms and the fume hoods in those rooms shall be controlled to allow for a variable flow of conditioned air into the room and exhaust through the fume hood while maintaining a safe face velocity at the hood sash opening.

B. Fume Hood Exhaust Air Controller: The air flow through the open face of the hood, regardless of sash position, shall be controlled at a face velocity between 30 to 36 meter per minute (100 fpm and 120 fpm). A velocity sensor controller located in a sampling tube in the side wall of the hood shall control a damper in the hood discharge to maintain the face velocity.

C. Room Differential Pressure Controller: The differential pressure in laboratory rooms shall be maintained by controlling the quantity of air exhausted from or supplied to the room. A sensor-controller shall measure and control the velocity of air flowing into or out of the room through a sampling tube installed in the wall separating the room from the adjacent space and display the value on its monitor. The controller shall have an operating range that will maintain a differential pressure at any set point between 0.75 Pascal (0.003 inches W.G.) and 7.5 Pascal (0.03 inches W.G.), and shall have accuracy ± 2 percent of reading.

2.8 FINAL CONTROL ELEMENTS AND OPERATORS

A. Fail Safe Operation: Control valves and dampers shall provide "fail safe" operation in either the normally open or normally closed position as required for freeze, moisture, and smoke or fire protection.

B. Spring Ranges: Range as required for system sequencing and to provide tight shut-off.

C. Power Operated Control Dampers (other than VAV Boxes): Factory fabricated, balanced type dampers. All modulating dampers shall be

opposed blade type and gasketed. Blades for two-position, duct-mounted dampers shall be parallel, airfoil (streamlined) type for minimum noise generation and pressure drop.

1. Leakage: Maximum leakage in closed position shall not exceed 7 L/S (15 CFMs) differential pressure for outside air and exhaust dampers and 200 L/S/ square meter (40 CFM/sq. ft.) at 50 mm (2 inches) differential pressure for other dampers.
2. Frame shall be galvanized steel channel with seals as required to meet leakage criteria.
3. Blades shall be galvanized steel or aluminum, 200 mm (8 inch) maximum width, with edges sealed as required.
4. Bearing shall be nylon, bronze sleeve or ball type.
5. Hardware shall be zinc-plated steel. Connected rods and linkage shall be non-slip. Working parts of joints shall be brass, bronze, nylon or stainless steel.

D. Smoke Dampers and Combination Fire/Smoke Dampers: Dampers and operators are specified in Section 233100, HVAC DUCTS AND CASINGS.

E. Operators shall be electric type.

1. Dampers that require manual reset or link replacement after actuation shall not be acceptable. See drawings for required control operation.
2. Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel.
3. Maximum air velocity and pressure drop through free area the dampers:
   a. Smoke damper in air handling unit; 210 meter per minute (700 fpm).
   b. Duct mounted damper; 600 meter per minute (2000 fpm).
   c. Maximum static pressure loss, 50 Pascal (0.20 inches water gage).

F. Control Valves:

1. Valves shall be rated for a minimum of 150 percent of system operating pressure at the valve location but not less than 400 psig. Close off pressure shall be minimum 200 psig.
2. Valves 50 mm (2 inches) and smaller shall be ball type, bronze body with threaded or flare connections.
3. Valves 60 mm (2 1/2 inches) and larger shall be globe type, bronze or iron body with flanged connections.
4. Brass or bronze seats except for valves controlling media above 100 degrees C (210 degrees F), which shall have stainless steel seats.
5. Flow characteristics:
   a. Three way valves shall have a linear relation or equal percentage relation of flow versus value position.

b. Two-way valves position versus flow relation shall be linear for steam and equal percentage for water flow control.

6. Maximum pressure drop:
   a. Two position steam control: 20 percent of inlet gauge pressure.
   b. Modulating Steam Control: 60 percent of inlet gauge pressure.
   c. Modulating water flow control, 3 meters (10 feet) of water or the pressure drop through the apparatus
   d. Two position water valves shall be line size.

G. Damper and Valve Operators and Relays:
1. Electric damper operator shall provide full modulating control of dampers. A linkage and pushrod shall be furnished for mounting the actuator on the damper frame or externally on the duct wall, or shall be furnished with a direct-coupled design.
2. Electronic damper operators: VAV Box actuator shall be mounted on the damper axle or shall be of the air valve design, and shall provide complete modulating control of the damper. The motor shall have a closure torque of 35-inch pounds minimum with full torque applied at close off to attain minimum leakage.
3. Relays shall be of the following type:
   a. Electrical Interlocking Relays: Electric-pneumatic (EP) or pneumatic-electric (PE) types.
   b. Electrical pilot duty of contactor types: Provide inductive rated contacts for circuits with coils, motors or other inductive devices.

2.9 AIR FLOW CONTROL

A. Airflow and static pressure shall be controlled via digital controller (CUs) with inputs from airflow control measuring stations and static pressure inputs as specified. Controller outputs shall be true analog output signals to variable frequency drives. Pulse width modulation outputs are not acceptable. The CUs shall include the capability to control via simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The airflow control programs shall be factory-tested programs that are documented in the literature of the control manufacturer.

B. Air flow measuring station-electronic thermal type.
1. Air Flow Sensor Probe:
   a. Each thermal sensor shall contain two individual sensing elements. One element shall determine the velocity of the air stream while the other element shall compensate for changes in temperature.

Each thermal flow sensor and its associated control circuit and signal conditioning circuit shall be factory calibrated and be interchangeable to allow replacement of a sensor without recalibration of the entire flow station. The sensor in the array shall be located at the center of equal area segment of the duct and the number of sensors shall be adequate to accommodate the expected velocity profile and variation in flow and temperature. The airflow station shall be of the insertion type in which sensor support structures are inserted from the outside of the ducts to make up the complete electronic velocity array.

b. Thermal flow sensor shall be constructed of hermetically sealed thermistors or nickel chromium or reference grade platinum wire, wound over an epoxy, stainless steel or ceramic mandrel and coated with a material suitable for the conditions to be encountered. Each dual sensor shall be mounted in an extruded aluminum strut.

c. Thermal sensors and its sensor holder shall not exhibit more than +/- 2 percent error in output for variations in the angle of flow of up to 10 percent in any direction from its calibrated orientation.

d. Air flow measuring station shall be Gold Series GP1 Model as manufactured by Ebtron or approved equal.

2. Electronics Panel:

a. Electronics panel shall consist of a surface mounted enclosure complete with solid-state microprocessor and software.

b. Electronic panel shall be A/C powered 120 VAC or 24 VAC and shall have the capability to transmit signals of 0-5 VDC, 0-10 VCD or 4-20 ma for use in control of the HVAC Systems. The electronic panel shall have the capability to accept user defined scaling parameters for all output signals.

c. The electronic panel shall have the capability to digitally display airflow and temperature in CFM for flow and degree F for temperature. The displays shall be provided as an integral part of the electronics panel. The electronic panel shall have the capability to totalize the output flow in CFM for two or more systems, as required. A single output signal may be provided which will equal the sum of the systems totalized. Output signals shall be provided for temperature and airflow. Provide remote mounted CFM or temperature displays.

3. Pressure drop through the flow station shall not exceed 4 Pascal

(0.015" W.G.) at 1,000 meter per minute (3,000 FPM).

4. The entire system shall be factory calibrated in an NBS traceable wind tunnel to an accuracy of +/- 2 percent reading at +1/2 percent of full range over a temperature range of -20 to 60 degrees C (0 to 125 degrees F) and a velocity range of 30 meters per minute to 1,500 meter per minute (100-5,000 fpm). Repeatability shall be no more than +/- 0.5 percent of reading.
5. Thermal flow sensors and its electronics shall be installed as per manufacturer’s instructions. The number of sensors shall be such that accuracy of the total flow rate shall no way be different than what is specified in Article 1.5 above.
   a. Static Pressure Control: Systems shall consist of one or more static pressure sensors and transmitters along with relays or auxiliary devices as required for a complete functional system. The span of the transmitter shall not exceed two times the design static pressure at the point of measurement. The output of the transmitter shall be true representation of the input pressure with plus or minus 25 Pascal (0.1 inch) W.G. of the true input pressure.
      1) Static pressure sensors shall have the same requirements as Airflow Measuring Devices except that total pressure sensors are optional, and only multiple static pressure sensors positioned on an equal area basis connected to a network of headers are required.
      2) For systems with multiple major trunk supply duct, furnish a static pressure transmitter for each trunk duct. The transmitter signal representing the lowest static pressure shall be selected and this shall be the input signal to the CU.
      3) The CU shall receive the static pressure transmitter signal and CU shall provide a control output signal to the supply fan capacity control device. The control mode shall be proportional plus integral (PI) (automatic reset) and where required shall also include derivative mode.
      4) In systems with multiple static pressure transmitters, provide a switch located near the fan discharge to prevent excessive pressure during abnormal operating conditions.
   b. Airflow Synchronization:
      1) Systems shall consist of an air flow measuring station for supply and exhaust fans, the CU and such relays, as required to

provide a complete functional system that will maintain a constant flow rate difference between supply and exhaust air to an accuracy of ±5%. In systems where there is no suitable location for a flow measuring station that will sense total supply or exhaust flow, provide multiple flow stations with a differential pressure transmitter for each station. Signals from the multiple transmitters shall be added through the CU such that the resultant signal is a true representation of total flow.

2) The total flow signals from supply and exhaust air shall be the input signals to the CU. This CU shall track the exhaust air fan capacity in proportion to the supply air flow under all conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to Resident Engineer for resolution before proceeding for installation.
2. Work Coordination: Section 010000, GENERAL CONDITIONS.
3. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
4. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
5. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
6. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
7. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
8. Install equipment level and plum.

B. Piping Installation:

1. All piping associated with smoke control shall be hard drawn copper.
2. Tubing passing through or buried in concrete shall be installed in rigid steel conduit of sufficient strength to prevent damage to tubing.

3. Install polyethylene tubing in metallic raceway or electrical conduit. Electrical conduits installations are specified in Division 26.
4. Welding shall be performed in accordance with Section 232113, HYDRONIC PIPING.
5. Label and identify control air piping in accordance with specification Section 230511,COMMON WORK RESULT FOR HVAC AND STEAM GENERATION.

C. Electrical Wiring Installation:
1. Install conduits and wiring in accordance with Specification Section 260533,RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
2. Install signal and communication cables in accordance with Specification Section 260521, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS and BELOW).
3. Install conduit and wiring between operator workstation(s), digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as shown on the drawings. All wiring shall be installed in conduits.
4. Install all system components in accordance with local Building Code and National Electric Code.
   a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
   b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
   c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.
   d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.
5. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
6. Permanently label or code each point of all field terminal strips to

show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.

7. Grounding: ground electrical systems per manufacturer’s written requirements for proper and safe operation.

D. Install Sensors and Controls:

1. Temperature Sensors:
   a. Install all sensors and instrumentation according to manufacturer’s written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.
   b. Calibrate sensors to accuracy specified, if not factory calibrated.
   c. Use of sensors shall be limited to its duty, e.g., duct sensor shall not be used in lieu of room sensor.
   d. Install room sensors permanently supported on wall frame. They shall be mounted at 1.5 meter (5.0 feet) above the finished floor.
   e. Mount sensors rigidly and adequately for the environment within which the sensor operates.
   f. Sensors used in mixing plenum, and hot and cold decks shall be of the averaging of type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
   g. All pipe mounted temperature sensors shall be installed in wells.
   h. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.
   i. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.
2. Pressure Sensors:
   a. Install duct static pressure sensor tips facing directly downstream of airflow.
   b. Install high-pressure side of the differential switch between the pump discharge and the check valve.
   c. Install snubbers and isolation valves on steam pressure sensing devices.

3. Actuators:
   a. Mount and link damper and valve actuators according to manufacturer's written instructions.
   b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.
   c. Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.
4. Flow Switches:
   a. Install flow switch according to manufacturer's written instructions.
   b. Mount flow switch a minimum of 5 pipe diameters up stream and 5 pipe diameters downstream or 600 mm (2 feet) whichever is greater, from fittings and other obstructions.
   c. Assure correct flow direction and alignment.
   d. Mount in horizontal piping-flow switch on top of the pipe.

E. Installation of Network:
1. Ethernet:
   a. The network shall employ Ethernet LAN architecture, as defined by IEEE 802.3. The Network Interface shall be fully Internet Protocol (IP) compliant allowing connection to currently installed IEEE 802.3, Compliant Ethernet Networks.
   b. The network shall directly support connectivity to a variety of cabling types. As a minimum provide the following connectivity: 10 Base 2 (ThinNet RG-58 A/U Coaxial cabling with BNC connectors), 10 Base T (Twisted-Pair RJ-45 terminated UTP cabling).
2. Echelon:
   a. The ECC shall employ LonTalk communications FTT-10.
   b. Echelon LAN (Flat LON): The ECC shall employ a LON LAN that will connect through an Echelon Communication card directly to all controllers on the FTT-10 LAN.
3. Third Party Interfaces: Contractor shall integrate real-time data from building systems by other trades and databases originating from other manufacturers as specified and required to make the system work as one system.

F. Installation of Digital Controllers and Programming:
1. Provide a separate digital controller for each major piece of equipment, such as air handling unit, pumping unit etc. Points used

for control loop reset such as outdoor air, outdoor humidity, or space temperature could be located on any of the remote control units.

2. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25 percent of available memory free for future use.
3. System point names shall be modular in design, permitting easy operator interface without the use of a written point index.
4. Provide software programming for the applications intended for the systems specified, and adhere to the strategy algorithms provided.
5. Provide graphics for each piece of equipment and floor plan in the building. This includes each chiller, cooling tower, air handling unit, fan, terminal unit, boiler, pumping unit etc. These graphics shall show all points dynamically as specified in the point list.

3.2 SYSTEM VALIDATION AND DEMONSTRATION

A. As part of final system acceptance, a System Demonstration is required. Prior to start of this Demonstration, the contractor is to perform a complete Validation of all aspects of the Controls and Instrumentation System.

B. Validation

1. Prepare and submit for approval a Validation Test Plan including Test Procedures for the performance verification tests. Test Plan shall address all specified functions of the Engineering Control Center and all specified sequences of operation. Explain in detail actions and expected results used to demonstrate compliance with the requirements of this specification. Explain the method for simulating the necessary conditions of operation used to demonstrate performance of the system. Test Plan shall include a Test Check List to be used by the Installer’s agent to check and initial that each test has been successfully completed. Deliver Test Plan documentation for the performance verification tests to the owner’s representative 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.
2. After approval of the Validation Test Plan, Installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to insure that system performs in accordance with approved specifications and sequences of operation submitted. Installer shall

complete and submit Test Check List.

C. Demonstration

1. System operation and calibration to be demonstrated by the Installer in the presence of the Architect and Owner's representative on random samples of equipment as dictated by the Owner’s representative. Should random sampling indicate improper commissioning, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the owner.
2. Demonstrate to authorities that all required safeties and life safety functions are fully functional and complete.
3. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
4. The following witnessed demonstrations of field control equipment shall be included:
   a. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
   b. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
   c. Demonstrate the software ability to edit the control program off-line.
   d. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned location, including operator workstations.
   e. Demonstrate ability of software program to function for the intended applications-trend reports, change in status etc.
   f. Demonstrate via graphed trends to show the sequence of operation is executed in correct manner, and that the HVAC systems operate properly through the complete sequence of operation, e.g., seasonal change, occupied/unoccupied mode, and warm-up condition.
   g. Demonstrate hardware interlocks and safeties functions, and that the control systems perform the correct sequence of operation after power loss and resumption of power loss.
   h. Prepare and deliver to the VA graphed trends of all control loops to demonstrate that each control loop is stable and the set points are maintained.
   i. Demonstrate that each control loop responds to set point adjustment and stabilizes within one (1) minute. Control loop trend data shall be instantaneous and the time between data points

shall not be greater than one (1) minute.

----- END -----

SECTION 23 21 13
HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Water piping to connect HVAC equipment, including the following:
   1. Chilled water, heating hot water and drain piping.

1.2 RELATED WORK

A. Seismic restraints for piping: Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
B. General mechanical requirements and items, which are common to more than one section of Division 23: Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
C. Pumps: Section 232123, HYDRONIC PUMPS.
D. Piping insulation: Section 230711, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
E. Water treatment for closed systems: Section 232500, WATER TREATMENT.
F. VAV and CV units: Section 233600, AIR TERMINAL UNITS.
G. Temperature and pressure sensors and valve operators: Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
H. Section 010000, GENERAL REQUIREMENTS.
I. Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 QUALITY ASSURANCE

A. Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, which includes welding qualifications.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data:
   1. Pipe and equipment supports.
   2. Pipe and tubing, with specification, class or type, and schedule.
   3. Pipe fittings, including miscellaneous adapters and special fittings.
   4. Flanges, gaskets and bolting.
   5. Valves of all types.
   6. Strainers.
   7. Flexible connectors for water service.
   8. Pipe alignment guides.
   9. Expansion joints.
   10. All specified hydronic system components.

11. Radiant ceiling panels.
12. Gages.
13. Thermometers and test wells.
14. Seismic bracing details for piping.

C. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
   1. Convertors.
   2. Air separators.
   3. Expansion tanks.

D. Coordination Drawings: Refer to Article, SUBMITTALS of Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

E. As-Built Piping Diagrams in scale 1/4″ = 1′ 0″: Provide drawing as follows for chilled water, and heating hot water system.
   1. One wall-mounted stick file for prints. Mount stick file in the chiller plant or adjacent control room along with control diagram stick file.
   2. One set of reproducible drawings.
   3. One complete set of drawings in each electronic format (AutoCad and PDF).

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):

B1.20.1-83.....Pipe Threads, General Purpose (Inch)
B16.1-98.....Cast Iron Pipe Flanges and Flanged Fittings
B16.3-98.....Malleable Iron Threaded Fittings
B16.4-98.....Gray Iron Threaded Fittings
B16.5-03.....Pipe Flanges and Flanged Fittings
B16.9-03.....Factory-Made Wrought Buttwelding Fittings
B16.11-05.....Forged Fittings, Socket-Welding and Threaded
B16.14-91.....Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads
B16.22-01.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
B16.23-02.....Cast Copper Alloy Solder Joint Drainage Fittings
B16.24-01.....Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500

B16.39-98.....Malleable Iron Threaded Pipe Unions, Classes 150, 250, and 300

B16.42-98.....Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300

B31.1-01.....Power Piping

B31.9-04.....Building Services Piping

B40.100-05.....Pressure Gauges and Gauge Attachments

C. American National Standards Institute, Inc. (ANSI):

B16.1 00.....Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125 and 250

B16.3 00.....Malleable Iron Threaded Fittings Classes 150 and 300

B16.5 03.....Pipe Flanges and Flanged Fittings NPS ½ through NPS 24

B16.9 03.....Factory Made Wrought Butt Welding Fittings

B16.11 01.....Forged Fittings, Socket Welding and Threaded

B16.14 91.....Ferrous Pipe Plugs, Bushings and Locknuts with Pipe Threads

B16.18-01.....Cast Copper Alloy Solder joint Pressure fittings

B16.22 00.....Wrought Copper and Bronze Solder Joint Pressure Fittings

B16.24 01.....Cast Copper Alloy Pipe Fittings and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500

B31.1 01.....Power Piping

D. American Society for Testing and Materials (ASTM):

A47/A47M-99 (2004).....Ferritic Malleable Iron Castings

A53/A53M-06.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A106/A106M-06.....Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

A126-04.....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A181/A181M-01.....Standard Specification for Carbon Steel Forgings, for General-Purpose Piping

A183-03 ..... Standard Specification for Carbon Steel Track Bolts and Nuts

A216/A216M-04 ..... Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service

A234/A234M 04 ..... Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

A307-04 ..... Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

A536-84 (2004) ..... Standard Specification for Ductile Iron Castings

A 615/A 615M-04 ..... Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A653/A 653M-04 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) By the Hot-Dip Process

B32-04 ..... Standard Specification for Solder Metal

B61-02 ..... Standard Specification for Steam or Valve Bronze Castings

B62-02 ..... Standard Specification for Composition Bronze or Ounce Metal Castings

B88-03 ..... Standard Specification for Seamless Copper Water Tube

B209 04 ..... Aluminum and Aluminum Alloy Sheet and Plate

C177 97 ..... Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus

C478-03 ..... Precast Reinforced Concrete Manhole Sections

C533 03 ..... Calcium Silicate Block and Pipe Thermal Insulation

C552 03 ..... Cellular Glass Thermal Insulation

E. American Water Works Association (AWWA):

C110/03.....Ductile Iron and Grey Iron Fittings for Water

F. American Welding Society (AWS):

A5.8/A5.8M-04.....Specification for Filler Metals for Brazing and Braze Welding

B2.1-02.....Standard Welding Procedure Specification

G. Copper Development Association, Inc. (CDA):

CDA A4015-95.....Copper Tube Handbook

H. Expansion Joint Manufacturer’s Association, Inc. (EJMA):

EMJA-2003.....Expansion Joint Manufacturer’s Association Standards, Eighth Edition

I. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:

SP-67-02a.....Butterfly Valves

SP-70-06.....Gray Iron Gate Valves, Flanged and Threaded Ends
SP-71-05.....Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-99.....Ball Valves with Flanged or Butt-Welding Ends for General Service
SP-78-05.....Cast Iron Plug Valves, Flanged and Threaded Ends
SP-80-03.....Bronze Gate, Globe, Angle and Check Valves
SP-85-02.....Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

J. National Sanitation Foundation (NSF):
14 03.....Plastic Piping System Components and Related Materials

K. Tubular Exchanger Manufacturers Association: TEMA 8th Edition, 2000

L. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
HVAC Duct Construction Standards, 2nd Edition 1997

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

Provide in accordance with Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

2.2 PIPE AND TUBING

A. Chilled Water (above ground), Heating Hot Water, and Vent Piping:
1. Steel: ASTM A53 Grade B, seamless, Schedule 40.
2. Copper water tube option: ASTM B88, Type K or L, hard drawn.

B. Extension of Domestic Water Make-up Piping: ASTM B88, Type K or L, hard drawn copper tubing.

C. Cooling Coil Condensate Drain Piping:
1. From air handling units: Copper water tube, ASTM B88, Type M.

2.3 FITTINGS FOR STEEL PIPE

A. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints.
1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
2. Welding flanges and bolting: ASME B16.5:
a. Water service: Weld neck or slip-on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).
b. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.

B. 50 mm (2 inches) and Smaller: Screwed or welded..
   1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.
   2. Forged steel, socket welding or threaded: ASME B16.11.
   3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
   4. Unions: ASME B16.39.
   5. Water hose connection adapter: Brass, pipe thread to 20 mm (3/4 inch) garden hose thread, with hose cap nut.

C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and thredolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.

2.4 FITTINGS FOR COPPER TUBING

A. Solder Joint:
   1. Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.

B. Bronze Flanges and Flanged Fittings: ASME B16.24.

2.5 DIELECTRIC FITTINGS

A. Provide where copper tubing and ferrous metal pipe are joined.

B. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.

C. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.

D. Temperature Rating, 99 degrees C (210 degrees F) for water systems.

2.6 SCREWED JOINTS

A. Pipe Thread: ANSI B1.20.

B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.7 VALVES

A. Asbestos packing is not acceptable.

B. All valves of the same type shall be products of a single manufacturer. Provide gate and globe valves with packing that can be replaced with the valve under full working pressure.

C. Provide chain operators for valves 100 mm (4 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.

D. Gate Valves:

1. 50 mm (2 inches) and smaller: MSS-SP80, Bronze, 1034 kPa (150 lb.), wedge disc, rising stem, union bonnet.
2. 65 mm (2 1/2 inches) and larger: Flanged, outside screw and yoke.
   a. MSS-SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.

E. Globe Valves:
1. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Globe valves shall be union bonnet with metal plug type disc.
2. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85.

F. Non-Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut-off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.
1. Body: Cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.
2. Seat, disc and spring: 18-8 stainless steel, or bronze, ASTM B62.

G. Butterfly Valves: May be used in lieu of gate valves in water service except for direct buried pipe. Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation.
1. MSS-SP 67, flange lug type (for end of line service).
   a. Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65-45-12 electro-plated.
   b. Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.

H. Ball Valves: Brass or bronze body with chrome-plated ball with full port and Teflon seat at 2760 kPa (400 psig) working pressure rating. Screwed or solder connections. Provide stem extension to allow operation without interfering with pipe insulation.

I. Circuit Setter Valve: A dual purpose flow balancing valve and adjustable flow meter, with bronze or cast iron body, adjustable memory stop, 100% shutoff, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

2.8 STRAINERS

A. Y Type.

B. Screens: 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows:

1. 75 mm (3 inches) and smaller: 1.1 mm (0.045 inch) diameter perforations for liquids.
2. 100 mm (4 inches) and larger: 3.2 mm (0.125 inch) diameter perforations for liquids.

2.9 FLEXIBLE CONNECTORS FOR WATER SERVICE

A. Flanged Spool Connector:

1. Single arch or multiple arch type. Tube and cover shall be constructed of chlorobutyl elastomer with full faced integral flanges to provide a tight seal without gaskets. Connectors shall be internally reinforced with high strength synthetic fibers impregnated with rubber or synthetic compounds as recommended by connector manufacturer, and steel reinforcing rings.
2. Working pressures and temperatures shall be as follows:
   a. Connector sizes 50 mm to 100 mm (2 inches to 4 inches), 1137 kPa (165psig) at 121 degrees C (250 degrees F).
   b. Connector sizes 125 mm to 300 mm (5 inches to 12 inches), 965 kPa (140 psig) at 121 degrees C (250 degrees F).
3. Provide ductile iron retaining rings and control units.

2.10 EXPANSION JOINTS

A. Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.

B. Manufacturing Quality Assurance: Conform to Expansion Joints Manufacturers Association Standards.

C. Bellows - Internally Pressurized Type:

1. Multiple corrugations of Type 304 or Type A240-321 stainless steel.
2. Internal stainless steel sleeve entire length of bellows.
3. External cast iron equalizing rings for services exceeding 340 kPa (50 psig).
4. Welded ends.
5. Design shall conform to standards of EJMA and ASME B31.1.
6. External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in

direction of pipeline.

7. Integral external cover.

D. Expansion Joint Identification: Provide stamped brass or stainless steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number on the contract drawings.

E. Guides: Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides must be designed to withstand a minimum of 15 percent of the axial force which will be imposed on the expansion joints and anchors. Field-built guides may be used if detailed on the contract drawings.

2.11 HYDRONIC SYSTEM COMPONENTS

A. Convertor: Shell and tube type, U-bend removable tube bundle, steam in shell, water in tubes, equipped with support cradles.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Taco or acceptable equivalent by;
   b. Armstrong International, Inc.
   c. Bell & Gossett
2. Maximum tube velocity: 2.3 m/s (7.5 feet per second).
3. Tube fouling factor: TEMA Standards, 5th Edition, but not less than 0.001.
4. Materials:
   a. Shell: Steel.
   b. Tube shell and tube supports: Steel, seismically-rated and furnished by manufacturer.
   c. Tubes: 20 mm (3/4 inch) OD copper.
   d. Head or bonnet: Cast iron or steel.
   e. A vacuum breaker shall be installed on the shell (steam) side of heat exchanger to prevent steam hammer.
   f. Tube inlet of heat exchanger shall be single system inlet connection for water on heat transfer package. Thermometer shall be provided on heat exchanger outlet piping. Thermometer shall be 3″ dial type with 2-1/2″ stem, stainless steel case, glass front, 1/2″ NPT back connected with range of 50 degree to 300 degree F.
   g. Refer to schedule on drawings for additional information.
5. Construction: In accordance with ASME Pressure Vessel Code rated for 150 psig working pressure for shell and tubes. Provide manufacturer's

certified data report, Form No. U-1.

B. Tangential Air Separator: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, flanged tangential inlet and outlet connection, internal perforated stainless steel air collector tube designed to direct released air into expansion tank, bottom blowdown connection. Provide Form No. U-1. Provide a removable stainless steel strainer element having 5 mm (3/16 inch) perforations and free area of not less than five times the cross-sectional area of connecting piping.

C. Diaphragm Type Pre-Pressurized Expansion Tank: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, welded steel shell, rust-proof coated, with a flexible elastomeric diaphragm suitable for a maximum operating temperature of 116 degrees C (240 degrees F). Provide Form No. U-1. Tank shall be equipped with system connection, drain connection, standard air fill valve and be factory pre-charged to a minimum of 83 kPa (12 psig).

D. Pressure Reducing Valve (Water): Diaphragm or bellows operated, spring loaded type, with minimum adjustable range of 28 kPa (4 psig) above and below set point. Bronze, brass or iron body and bronze, brass or stainless steel trim, rated 861 kPa (125 psig) working pressure at 107 degrees C (225 degrees F).

E. Pressure Relief Valve: Bronze or iron body and bronze or stainless steel trim, with testing lever. Comply with ASME Code for Pressure Vessels, Section 8, and bear ASME stamp.

F. Automatic Air Vent Valves (where shown): Cast iron or semi-steel body, 1034 kPa (150 psig) working pressure, stainless steel float, valve, valve seat and mechanism, minimum 15 mm (1/2 inch) water connection and 6 mm (1/4 inch) air outlet.

2.12 WATER FILTERS AND POT CHEMICAL FEEDERS

A. See section 232500, HVAC WATER TREATMENT, Article 2.2, CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS.

2.13 GAGES, PRESSURE AND COMPOUND

A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, steam, oil or water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

B. Provide brass, lever handle union cock. Provide brass/bronze pressure

snubber for gages in water service.

C. Range of Gages: For services not listed provide range equal to at least 130 percent of normal operating range:

D. Mercury-filled gauges will not be acceptable.

2.14 PRESSURE/TEMPERATURE TEST PROVISIONS

A. Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

B. Provide one each of the following test items to the Resident Engineer:

1. 6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.
2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gage, , 762 mm (30 inches) Hg to 689 kPa (100 psig) range.
3. 0 - 104 degrees C (220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

2.15 THERMOMETERS

A. Organic liquid filled type, red or blue column, clear plastic window, with 150 mm (6 inch) brass stem, straight, fixed or adjustable angle as required for each in reading.

B. Case: Chrome plated brass or aluminum with enamel finish.

C. cale: Not less than 225 mm (9 inches), range as described below, two degree graduations.

D. Separable Socket (Well): Brass, extension neck type to clear pipe insulation.

E. Scale ranges may be slightly greater than shown to meet manufacturer's standard. Required ranges in degrees C (F):

F. Mercury-filled thermometers will not be acceptable.

Chilled Water 0 to 38 degrees C (32-100 degrees F)	Hot Water-1 to 116 degrees C (30 to 240 degrees F).

2.16 FIRESTOPPING MATERIAL

Refer to Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

PART 3 - EXECUTION

3.1 GENERAL

A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, coils, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

C. Support piping securely. Refer to PART 3, Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION. Install convertors and other heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.

D. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

E. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

F. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.

G. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.

H. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:
   1. Water treatment pot feeders.
   2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

I. Thermometer Wells: In pipes 65 mm (2-1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.

J. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 230711, HVAC, PLUMBING AND BOILER PLANT INSULATION.

K. Where copper piping is connected to steel piping, provide dielectric connections.

3.2 PIPE JOINTS

A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder’s qualification requirements under "Quality Assurance" in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

C. Solvent Welded Joints: As recommended by the manufacturer.

3.3 EXPANSION JOINTS (BELLOWS TYPE)

A. Anchors and Guides: Provide type, quantity and spacing as recommended by manufacturer of expansion joint and as shown. A professional engineer shall verify in writing that anchors and guides are properly designed for forces and moments which will be imposed.

B. Cold Set: Provide setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.

C. Preparation for Service: Remove all apparatus provided to restrain joint during shipping or installation. Representative of manufacturer shall visit the site and verify that installation is proper.

D. Access: Expansion joints must be located in readily accessible space. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding packing.

3.4 SEISMIC BRACING

A. Provide is accordance with Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LEAK TESTING

A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer. Tests may be either of those below, or a combination, as approved by the Resident Engineer.

B. An operating test at design pressure, and for hot systems, design maximum temperature.

C. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Avoid excessive pressure on mechanical seals and safety devices.

3.6 FLUSHING AND CLEANING PIPING SYSTEMS

A. Water Piping: Clean systems as recommended by the suppliers of chemicals specified in Section 232500, HVAC WATER TREATMENT.

1. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/S (6 feet per second), if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the Resident Engineer.

2. Cleaning: Using products supplied in Section 232500, HVAC WATER TREATMENT, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris

accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 1.8 m/S (6 feet per second). Circulate each section for not less than four hours. Blow-down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.

3. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.7 WATER TREATMENT

A. Install water treatment equipment and provide water treatment system piping.

B. Close and fill system as soon as possible after final flushing to minimize corrosion.

C. Charge systems with chemicals specified in Section 232500, HVAC WATER TREATMENT.

D. Utilize this activity, by arrangement with the Resident Engineer, for instructing VA operating personnel.

3.8 OPERATING AND PERFORMANCE TEST AND INSTRUCTION

A. Refer to PART 3, Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Adjust red set hand on pressure gages to normal working pressure.

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SECTION 23 21 23
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Pumps for Heating, Ventilating and Air Conditioning.

B. Definitions:

1. Capacity: Liters per second (L/s) (Gallons per minute (GPM) of the fluid pumped.
2. Head: Total dynamic head in kPa (feet) of the fluid pumped.
3. Flat head-capacity curve: Where the shutoff head is less than 1.16 times the head at the best efficiency point.

1.2 RELATED WORK

A. Section 010000, GENERAL REQUIREMENTS.

B. Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

D. Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

E. Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC AND EQUIPMENT.

F. Section 232113, HYDRONIC PIPING.

G. Section 230512, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

H. Section 262911, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALITY ASSURANCE, in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Design Criteria:

1. Pumps design and manufacturer shall conform to Hydraulic Institute Standards.
2. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.
3. Head-capacity curves shall slope up to maximum head at shut-off. Curves shall be relatively flat for closed systems. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable operation. Select pumps for open systems so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA).

4. The head for pumps submitted for pumping through condensers and through chilled water coils and evaporators shall be increased, if necessary, to match the equipment approved for the project.
5. Pump Driver: Furnish with pump. Size shall be non-overloading at any point on the head-capacity curve including one pump operation in a parallel or series pumping installation.
6. Provide all pumps with motors, full size impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts. Impeller shall be trimmed to meet specified performance at no extra cost.
7. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency.
8. Test all pumps before shipment. The manufacturer shall certify all pump ratings.
9. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.
10. Furnish one spare seal and casing gasket for each pump to the Resident Engineer.

C. Allowable Vibration Tolerance for Pump Units: Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Manufacturer's Literature and Data:
   1. Pumps and accessories.
   2. Motors and drives.
   3. Variable speed motor controllers.

C. Manufacturer's installation, maintenance and operating instructions, in accordance with Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

D. Characteristic Curves: Head-capacity, efficiency-capacity, brake horsepower-capacity, and NPSHR-capacity for each pump and for combined pumps in parallel or series service. Identify pump and show fluid pumped, specific gravity, pump speed and curves plotted from zero flow to maximum for the impeller being furnished and at least the maximum

diameter impeller that can be used with the casing.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only:

B. American Iron and Steel Institute (AISI):
AISI 1045.....Cold Drawn Carbon Steel Bar, Type 1045
AISI 416.....Type 416 Stainless Steel

C. American National Standards Institute (ANSI):
ANSI B15.1-00.....Safety Standard for Mechanical Power Transmission Apparatus
ANSI B16.1-00.....Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800

D. American Society for Testing and Materials (ASTM):
A48-98.....Gray Iron Castings
B62-02.....Composition Bronze or Ounce Metal Castings

E. Maintenance and Operating Manuals in accordance with Section 010000, General Requirements

PART 2 - PRODUCTS

2.1 CENTRIFUGAL PUMPS, BRONZE FITTED

In-Line Type:

A. Casing and Bearing Housing: Close-grained cast iron, ASTM A48.

B. Casing Wear Rings: Bronze.

C. Suction or Discharge 65 mm (2-1/2 inches) and Larger: Plain face flange, 850 kPa (125 psig), ANSI B16.1.

D. Casing Vent: Manual brass cock at high point.

E. Casing Drain and Gage Taps: 15 mm (1/2-inch) plugged connections minimum size.

F. Bearings: Regreaseable ball or roller type. Provide lip seal and slinger outboard of each bearing.

G. Impeller: Bronze, ASTM B62, enclosed type, keyed to shaft.

H. Shaft: Steel, AISI Type 1045 or stainless steel.

I. Shaft Seal: Manufacturer's standard mechanical type to suit pressure and temperature and fluid pumped.

J. Shaft Sleeve: Bronze or stainless steel.

K. Motor: Furnish with pump. Refer to Section 230512, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

L. Variable Speed Pumps:

1. The pumps shall be the type shown on the drawings and specified

herein flex coupled to an open drip-proof motor.

2. Variable Speed Motor Controllers: Refer to Section 252611, LOW-VOLAGE MOTOR STARTERS and to Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, paragraph, Variable Speed Motor Controllers. Furnish controllers with pumps and motors.
3. Pump operation and speed control shall be as shown on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's written instructions for pump mounting and start-up. Access/ Service space around pumps shall not be less than minimum space recommended by pumps manufacturer.

B. Support piping adjacent to pump such that no weight is carried on pump casing. First 3 hangers for each pipe shall be spring and neoprene type.

C. Permanently support in-line pumps by the connecting piping only, not from the casing or the motor eye bolt.

D. Sequence of installation for base-mounted pumps:
   1. Level and shim the unit base and grout to the concrete pad.
   2. Shim the driver and realign the pump and driver. Correct axial, angular or parallel misalignment of the shafts.
   3. Connect properly aligned and independently supported piping.
   4. Recheck alignment.

E. Coordinate location of thermometer and pressure gauges as per Section 232113, HYDRONIC PIPING.

3.2 START-UP

A. Verify that the piping system has been flushed, cleaned and filled.

B. Lubricate pumps before start-up.

C. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.

D. Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.

E. Perform field mechanical balancing if necessary to meet specified vibration tolerance.

F. Ensure the disposable strainer is free of debris prior to testing and balancing of the hydronic system.

G. After several days of operation, replace the disposable start-up strainer with a regular strainer in the suction diffuser.

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SECTION 23 22 13
STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Steam, condensate and vent piping inside buildings.

1.2 RELATED WORK

A. Seismic restraints for piping: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

B. General mechanical requirements and items, which are common to more than one section of Division 23: Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

C. Piping insulation: Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

D. Water treatment for open and closed systems: Section 23 25 00, HVAC WATER TREATMENT.

E. Convertor: Shell and Tube Type: Section 23 21 13, HYDRONIC PIPING.

F. Temperature and pressure sensors and valve operators: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

1.3 QUALITY ASSURANCE

Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, which includes welding qualifications.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Pipe and equipment supports.
2. Pipe and tubing, with specification, class or type, and schedule.
3. Pipe fittings, including miscellaneous adapters and special fittings.
4. Flanges, gaskets and bolting.
5. Valves of all types.
6. Strainers.
7. All specified steam system components.
8. Gages.
9. Thermometers and test wells.
10. Seismic bracing details for piping.

C. Coordination Drawings: Refer to Article, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

D. As-Built Piping Diagrams in scale 1/4″ = 1′ 0″: Provide drawing as follows for steam and steam condensate piping and other central plant equipment.
   1. One wall-mounted stick file for prints. Mount stick file in the chiller plant or adjacent control room along with control diagram stick file.
   2. One set of reproducible drawings.
   3. One complete set of drawings in each electronic format (AutoCad and PDF).

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Institute Standard (ANSI):
   B1.20.1-01.....Pipe Threads, General Purpose (Inch)

C. American Society of Mechanical Engineers (ASME):
   B16.1-98.....Cast Iron Pipe Flanges and Flanged Fittings
   B16.3-98.....Malleable Iron Threaded Fittings
   B16.4-98.....Gray Iron Threaded Fittings
   B16.9-01.....Factory-Made Wrought Buttwelding Fittings
   B16.11-02.....Forged Fittings, Socket-Welding and Threaded
   B16.14-91.....Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads
   B16.39-98.....Malleable Iron Threaded Pipe Unions, Classes 150, 250, and 300
   B31.1-01.....Power Piping
   B31.9-96.....Building Services Piping
   B40.100-98.....Pressure Gauges and Gauge Attachments
   Boiler and Pressure Vessel Code: SEC VIII D1-2001, Pressure Vessels, Division 1

D. American Society for Testing and Materials (ASTM):
   A47-99.....Ferritic Malleable Iron Castings
   A53-01.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   A106-99.....Seamless Carbon Steel Pipe for High-Temperature Service
   A126-01.....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A181-01.....Carbon Steel Forgings, for General-Purpose Piping
A183-98 ..... Carbon Steel Track Bolts and Nuts
A216-98 ..... Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
A285-01 ..... Pressure Vessel Plates, Carbon Steel, Low-and-Intermediate-Tensile Strength
A307-00 ..... Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
A516-01 ..... Pressure Vessel Plates, Carbon Steel, for Moderate-and- Lower Temperature Service
A536-99 ..... Standard Specification for Ductile Iron Castings
B61-93 ..... Steam or Valve Bronze Castings
B62-93 ..... Composition Bronze or Ounce Metal Castings

E. American Welding Society (AWS):
A5.8-92.....Filler Metals for Brazing and Braze Welding
B2.1-00.....Welding Procedure and Performance Qualifications

F. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:
SP-67-95.....Butterfly Valves
SP-70-98.....Cast Iron Gate Valves, Flanged and Threaded Ends
SP-71-97.....Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-99.....Ball Valves with Flanged or Butt-Welding Ends for General Service
SP-78-98.....Cast Iron Plug Valves, Flanged and Threaded Ends
SP-80-97.....Bronze Gate, Globe, Angle and Check Valves
SP-85-94.....Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

G. Military Specifications (Mil. Spec.):
MIL-S-901D-1989.....Shock Tests, H.I. (High Impact) Shipboard Machinery, Equipment, and Systems

H. National Board of Boiler and Pressure Vessel Inspectors (NB): Relieving Capacities of Safety Valves and Relief Valves

I. Tubular Exchanger Manufacturers Association: TEMA 18th Edition, 2000

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

2.2 PIPE AND TUBING

A. Steam Piping: Steel, ASTM A53, Grade B; Schedule 40.

B. Steam Condensate Piping: Steel, ASTM A53, Grade B; Schedule 80.

2.3 FITTINGS FOR STEEL PIPE

A. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints.

1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
2. Welding flanges and bolting: ASME B16.5:
   a. Steam service: Weld neck or slip-on, raised face, with non-asbestos gasket. Non-asbestos gasket shall either be stainless steel spiral wound strip with flexible graphite filler or compressed inorganic fiber with nitrile binder rated for saturated and superheated steam service 750 degrees F and 1500 psi.
   c. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.

B. 50 mm (2 inches) and Smaller: Screwed or welded.

1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.
2. Forged steel, socket welding or threaded: ASME B16.11.
3. Screwed: Provide 300 pound malleable iron, ASME B16.3 for steam and steam condensate piping. Cast iron fittings are piping is not acceptable for steam and steam condensate piping. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
4. Unions: ASME B16.39.
5. Steam line drip station and strainer quick-couple blowdown hose connection: Straight through, plug and socket, screw or cam locking type for 15 mm (1/2 inch) ID hose.

C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and thredolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.

2.4 DIELECTRIC FITTINGS

A. Provide where copper tubing and ferrous metal pipe are joined.

B. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.

C. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.

D. Temperature Rating, 121 degrees C (250 degrees F) for steam condensate and as required for steam service.

2.5 SCREWED JOINTS

A. Pipe Thread: ANSI B1.20.

B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.6 VALVES

A. Asbestos packing is not acceptable.

B. All valves of the same type shall be products of a single manufacturer. Provide gate and globe valves with packing that can be replaced with the valve under full working pressure.

C. Provide chain operators for valves 100 mm (4 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.

D. Gate Valves:

1. 50 mm (2 inches) and smaller: MSS-SP80, Bronze, 1034 kPa (150 lb.), wedge disc, rising stem, union bonnet.
2. 65 mm (2 1/2 inches) and larger: Flanged, outside screw and yoke.
   a. MSS-SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.

E. Globe Valves:

1. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Globe valves shall be union bonnet with metal plug type disc.
2. 65 mm (2 1/2 inches) and larger:
   a. 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 .

2.7 STRAINERS

A. Y Type.

B. Rated 861 kPa (125 psig) saturated steam.

1. 65 mm (2-1/2 inches) and larger: Flanged, iron body.
2. 50 mm (2 inches) and smaller: Cast iron or bronze.

C. Screens: 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows:

1. 75 mm (3 inches) and smaller: 20 mesh for steam and 1.1 mm (0.045 inch) diameter perforations for liquids.

2. 100 mm (4 inches) and larger: 1.1 mm (0.045) inch diameter perforations for steam and 3.2 mm (0.125 inch) diameter perforations for liquids.

2.8 STEAM SYSTEM COMPONENTS

A. Safety Valves and Accessories: Comply with ASME Boiler and Pressure Vessel Code, Section VIII. Capacities shall be certified by National Board of Boiler and Pressure Vessel Inspectors, maximum accumulation 10 percent. Provide lifting lever. Provide drip pan elbow.

B. Steam Trap: Each type of trap shall be the product of a single manufacturer. Provide trap sets at all low points and at 61 m (200 feet) intervals on the horizontal main lines.

1. Floats and linkages shall provide sufficient force to open trap valve over full operating pressure range available to the system. Unless otherwise indicated on the drawings, traps shall be sized for capacities indicated at minimum pressure drop as follows:
   a. For equipment with modulating control valve: 1.7 kPa (1/4 psig), based on a condensate leg of 300 mm (12 inches) at the trap inlet and gravity flow.
2. Trap bodies: Bronze, cast iron, or semi-steel, constructed to permit ease of removal and servicing working parts without disturbing connecting piping. For systems without relief valve traps shall be rated for the pressure upstream of the PRV supplying the system.
3. Balanced pressure thermostatic elements: Phosphor bronze, stainless steel or monel metal.
4. Valves and seats: Suitable hardened corrosion resistant alloy.
5. Mechanism: Brass, stainless steel or corrosion resistant alloy.
6. Floats: Stainless steel.
7. Inverted bucket traps: Provide bi-metallic thermostatic element for rapid release of non-condensables.

C. Thermostatic Air Vent (Steam): Brass or iron body, balanced pressure bellows, stainless steel (renewable) valve and seat, rated 861 kPa (125 psig) working pressure, 20 mm (3/4 inch) screwed connections. Air vents shall be balanced pressure type that responds to steam pressure-temperature curve and vents air at any pressure.

2.9 GAGES, PRESSURE AND COMPOUND

A. ASME B40.1, Accuracy Grade 1A, (pressure, vacuum, or compound), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass

or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

B. Provide brass, lever handle union cock. Provide brass pigtail syphon for steam gages.

C. Range of Gages: For services not listed provide range equal to at least 130 percent of normal operating range:

Low pressure steam to 103 kPa(15 psig)	0 to 207 kPa (30 psig).

2.10 PRESSURE/TEMPERATURE TEST PROVISIONS

A. Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

B. Provide one each of the following test items to the Resident Engineer:

1. 6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.
2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gage, 762 mm (30 inches) Hg to 689 kPa (100 psig) range.
3. 0 - 104 degrees C (220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

2.11 FIRESTOPPING MATERIAL

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

PART 3 - EXECUTION

3.1 GENERAL

A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

C. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION. Install converters at height sufficient to provide gravity flow of condensate.

D. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope steam, condensate and drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat. Provide steam traps at end of line, at change in elevation and as shown on the Contract Documents. Take-offs shall be made from the top of the main.

E. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Provide unions and shut-off valves at all equipment.

F. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.

G. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:
   1. Control valves and wells for sensors.

H. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

I. Where copper piping is connected to steel piping, provide dielectric connections.

3.2 PIPE JOINTS

A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder’s qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

C. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

D. Solvent Welded Joints: As recommended by the manufacturer.

3.3 STEAM TRAP PIPING

A. Install to permit gravity flow to the trap. Provide gravity flow (avoid lifting condensate) from the trap where modulating control valves are used. Support traps weighing over 11 kg (25 pounds) independently of connecting piping.

3.4 SEISMIC BRACING

A. Provide is accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LEAK TESTING

A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer. All piping shall be tested before it is covered, concealed or made otherwise inaccessible. Tests may be either of those below, or a combination, as approved by the Resident Engineer.

B. An operating test at design pressure.

C. A hydrostatic test at 1.5 times design pressure. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Avoid excessive pressure on mechanical seals and safety devices.

D. The Contractor shall furnish all booster pumps, compressors, hoses and equipment required to perform all pressure tests. Tests shall be maintained as long as necessary to completely inspect piping and for the following minimum period.

   1. Steam systems: 4 hours.

E. The following precautions shall be taken during pressure tests:

   1. Steam traps shall be disconnected or isolated.
   2. System pressure gauges with scale ranges lower than test pressure shall be removed or isolated.
   3. Steam control valve shall be removed.

3.6 FLUSING AND CLEANING PIPING SYSTEMS

A. All piping systems shall be thoroughly cleaned before placing in operation to rid the system of dirt, piping compound, mill scale, oil and any and all other material foreign to the water being circulated.

This applies equally and especially to system where phases or portions of the systems are operated during construction.

B. After each system or portion of a system is complete, the Contractor shall add trisodium phosphate in a aqueous solution, to the system at the proportion of one pound per 5 0 gallons of water in the system. After system is filled with this solution, the system shall be brought up to temperature and allowed to circulate for 20 hours. The system shall then be drained completely. The Resident Engineer shall be given notice of this cleaning operation and will be present to observe the cleaning operation and if the Resident Engineer deems it necessary, the cleaning operation shall be repeated.

C. After each system has been completely cleaned as specified herein, it shall be tested by litmus paper or other dependable method and shall be left on the slightly alkaline side (pH -7.5 +/-). If the system is found to be still on the acid side, the cleaning by the use of trisodium phosphate shall be repeated.

D. The Contractor shall not add any water treatment chemicals or compounds to balance pH to the specified value.

3.7 OPERATING AND PERFORMANCE TEST AND INSTRUCTION

A. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Adjust red set hand on pressure gages to normal working pressure.

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SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies cleaning and treatment of circulating HVAC water systems, including the following.
   1. Cleaning compounds.
   2. Chemical treatment for closed loop heat transfer systems.

1.2 RELATED WORK

A. Test requirements and instructions on use of equipment/system: Section 010000, GENERAL REQUIREMENTS.

B. General mechanical requirements and items, which are common to more than one section of Division 23: Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

C. Piping and valves: Section 232113, HYDRONIC PIPING AND SECTION 232213, STEAM AND CONDENSATE HEATING PIPING.

1.3 QUALITY ASSURANCE

A. Refer to paragraph, QUALITY ASSURANCE in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Technical Services: Provide the services of an experienced water treatment chemical engineer or technical representative to direct flushing, cleaning, pre-treatment, training, debugging, and acceptance testing operations; direct and perform chemical limit control during construction period and monitor systems for a period of 12 months after acceptance, including not less than 4 service calls and written status reports. Minimum service during construction/start-up shall be 4 hours.

C. Field Quality Control and Certified Laboratory Reports: During the one year guarantee period, the water treatment laboratory shall provide not less than 12 reports based on on-site periodic visits, as stated in paragraph 1.3.B, sample taking and testing, and review with VA personnel, of water treatment control for the previous period. In addition to field tests, the water treatment laboratory shall provide certified laboratory test reports. These monitoring reports shall assess chemical treatment accuracy, scale formation, fouling and corrosion control, and shall contain instructions for the correction of any out-of-control condition.

D. Log Forms: Provide one year supply of preprinted water treatment test log forms.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Cleaning compounds and recommended procedures for their use.
2. Chemical treatment for closed systems, including installation and operating instructions.

C. Water analysis verification.

D. Materials Safety Data Sheet for all proposed chemical compounds, based on U.S. Department of Labor Form No. L5B-005-4.

E. Maintenance and operating instructions in accordance with Section 010000, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. National Fire Protection Association (NFPA):
70-05.....National Electric Code (NEC)

PART 2 - PRODUCTS

2.1 CLEANING COMPOUNDS

A. Alkaline phosphate or non-phosphate detergent/surfactant/specific to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.

B. All chemicals to be acceptable for discharge to sanitary sewer.

C. Refer to Section 232113, HYDRONIC PIPING and Section 232213, STEAM AND CONDENSATE HEATING PIPING, PART 3, for flushing and cleaning procedures.

2.2 CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS

A. Inhibitor: Provide sodium nitrite/borate, molybdate-based inhibitor or other approved proprietary compound suitable for make-up quality and make-up rate and which will cause or enhance bacteria/corrosion problems or mechanical seal failure due to excessive total dissolved solids. Shot feed manually. Maintain inhibitor residual as determined by water treatment laboratory, taking into consideration residual and temperature effect on pump mechanical seals.

B. pH Control: Inhibitor formulation shall include adequate buffer to maintain pH range of 8.0 to 10.5.

C. Performance: Protect various wetted, coupled, materials of construction including ferrous, and red and yellow metals. Maintain system essentially free of scale, corrosion, and fouling. Corrosion rate of following metals shall not exceed specified mills per year penetration; ferrous, 0-2; brass, 0-1; copper, 0-1. Inhibitor shall be stable at equipment skin surface temperatures and bulk water temperatures of, respectively, not less than 121 degrees C (250 degrees F) and 52 degrees C (125 degrees Fahrenheit). Heat exchanger fouling and capacity reduction shall not exceed that allowed by fouling factor 0.0005.

D. Pot Feeder: By-pass type, complete with necessary shut off valves, drain and air release valves, and system connections, for introducing chemicals into system, cast iron or steel tank with funnel or large opening on top for easy chemical addition. Feeders shall be 18.9 L (five gallon) minimum capacity at 860 kPa (125 psig) minimum working pressure.

2.3 EQUIPMENT AND MATERIALS IDENTIFICATION

Refer to Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Delivery and Storage: Deliver all chemicals in manufacturer's sealed shipping containers. Store in designated space and protect from deleterious exposure and hazardous spills.

B. Install equipment furnished by the chemical treatment supplier and charge systems according to the manufacturer's instructions and as directed by the Technical Representative.

C. Do not operate system pumps until after system has been cleaned.

D. Clean all strainers.

E. Perform tests and report results in accordance with Section 010000, GENERAL REQUIREMENTS.

F. Instruct VA personnel in system maintenance and operation in accordance with Section 010000, GENERAL REQUIREMENTS.

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SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Ductwork and accessories for HVAC including the following:
   1. Supply air, return air, outside air, exhaust, and relief systems.
   2. Corrosion resistant exhaust systems including the following:
      a. Lab hoods and ducts and accessories connected to hood exhaust system.

B. Definitions:
   1. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
   2. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
   3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
   4. Exposed Duct: Exposed to view in a finished room, exposed to weather.

1.2 RELATED WORK

A. Fire Stopping Material: Section 078400, FIRESTOPPING.

B. Seismic Reinforcing: Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

C. General Mechanical Requirements: Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

D. Noise Level Requirements: Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

E. Duct Insulation: Section 230711, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

F. Fume Hoods: Section 115313, LABORATORY FUME HOODS.

G. Air Flow Control Valves and Terminal Units: Section 233600, AIR TERMINAL UNITS.

H. Duct Mounted Coils: Section 238216, AIR COILS.

I. Supply Air Fans: Section 237300, INDOOR CENTRAL-STATION AIR HANDLING UNITS.

J. Return Air and Exhaust Air Fans: Section 233400, HVAC FANS.

K. Air Filters and Filters' Efficiencies: Section 234000, HVAC AIR CLEANING DEVICES.

L. Duct Mounted Instrumentation: Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

M. Testing and Balancing of Air Flows: Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

N. Smoke Detectors: Section 283100, FIRE DETECTION AND ALARM.

1.3 QUALITY ASSURANCE

A. Refer to article, QUALITY ASSURANCE, in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Fire Safety Code: Comply with NFPA 90A.

C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.

D. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for specified duct pressure classes.

E. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Rectangular ducts:
   a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
   b. Sealants and gaskets.
   c. Access doors.
2. Spiral round duct construction details:
   a. Manufacturer's details for duct fittings.
   b. Sealants and gaskets.
   c. Access sections.
   d. Installation instructions.
3. Volume dampers, back draft dampers.
4. Upper hanger attachments.
5. Fire dampers, fire doors, and smoke dampers with installation instructions.
6. Sound attenuators, including pressure drop and acoustic performance.
7. Flexible connections.

8. Instrument test fittings.
9. Perforated distribution plates.
10. Diffusers, registers, grilles and accessories.

C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Moving and Conditioning Association (AMCA):
500D-98.....Laboratory Method of Testing Dampers for Rating
500L-99.....Laboratory Method of Testing Louvers for Rating

C. American Society of Civil Engineers (ASCE):
ASCE7-98.....Minimum Design Loads for Buildings and Other Structures

D. American Society for Testing and Materials (ASTM):
A167-99.....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
A653-01.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
A1011-02.....Standard Specification for Steel Sheet and Strip Hot rolled Carbon structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability
B209-01.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C1071-00.....Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
E84-01.....Standard Test Method for Surface Burning Characteristics of Building Materials

E. National Fire Protection Association (NFPA):
90A-99.....Standard for the Installation of Air Conditioning and Ventilating Systems
96-01.....Ventilation Control and Fire Protection of Commercial Cooking Operations

F. Sheet Metal and Air Conditioning Contractors National Association

(SMACNA):

2nd Edition – 1995.....HVAC Duct Construction Standards, Metal and Flexible

1st Edition, 1985.....HVAC Air Duct Leakage Test Manual

6th Edition – 1992.....Fibrous Glass Duct Construction Standards

G. Underwriters Laboratories, Inc. (UL):

33-93.....UL Standard for Safety Heat Responsive Links for Fire Protection Service

181-96.....UL Standard for Safety Factory-Made Air Ducts and Connectors

555-02 .....Fire Dampers

555S-02 .....Smoke Dampers

PART 2 - PRODUCTS

2.1 DUCT MATERIALS AND SEALANTS

A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A527, coating G90.

B. Specified Corrosion Resistant Systems: Stainless steel sheet, ASTM A167, Class 302 or 304, Condition A (annealed) Finish No. 4 for exposed ducts and Finish No. 2B for concealed duct or ducts located in mechanical rooms.

C. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, paragraph S1.9.

1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.

2. Gaskets in Flanged Joints: Soft neoprene.

2.2 DUCT CONSTRUCTION AND INSTALLATION

A. Follow SMACNA HVAC Duct Construction Standards.

B. Duct Pressure Class: Primary supply ductwork from AHU to VAV boxes shall be 1000 Pa (4 inch W.G.). Secondary supply ductwork from VAV boxes to air outlets shall be 500 Pa (2 inch W.G.). All return air, exhaust air and ventilation systems ductwork shall be 500 Pa (2 inch W.G.). All exhaust air ductwork connected to lab hood shall be 1500 Pa (6 inch W.G.).

C. Seal Class: Shall be “A” and in accordance with SMACNA HVAC Air Duct Leakage Test Manual.

D. All Interior and Exterior Exhaust Ducts Connected to Lab Hood: Welded Stainless steel.

E. Spiral Round Ducts: Furnish duct and fittings made by the same manufacturer to insure good fit of slip joints. When submitted and approved in advance, round duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown on the drawings.

   1. Elbows: Diameters 80 through 200 mm (3 through 8 inches) shall be two sections die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.

   2. Provide bell mouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA HVAC Duct Construction Standards.

F. All exhaust ductwork serving fume hoods shall be stainless steel with continuous external weld for all seams and joints.

G. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches) wide by 1200 - 1350 mm (48 - 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

H. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multi-blade Volume Dampers.

I. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.

2.3 DUCT ACCESS DOORS, PANELS AND SECTIONS

A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:

   1. Each duct mounted coil.

   2. Each fire damper (for link service), smoke damper and automatic control damper.

3. Each duct mounted smoke detector.

B. Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12 inch) minimum where possible. Access sections in insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.
   1. For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards (Figure 2-12).
   2. For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure 2-11).

2.4 FIRE DAMPERS

A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2 hour rating, 70 degrees C (160 degrees F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

B. Type: Dynamic rated. Static rated dampers are not acceptable.

C. Fire dampers in wet air exhaust shall be of stainless steel construction, all others may be galvanized steel.
   1. Provide sleeves and mounting angles, minimum 1.9 mm (14 gage), required to provide installation equivalent to the damper manufacturer's UL test installation.
   2. Submit manufacturer's installation instructions conforming to UL rating test.
   3. Combination fire and smoke dampers: Multi-louver or curtain type units meeting all requirements of both dampers shall be used where shown.

2.5 SMOKE DAMPERS

A. Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 450 m/min (1500 fpm). Maximum static pressure loss: 32 Pa (0.13 inch W.G.).

B. Maximum air leakage, closed damper: 0.32 cubic meters /min/square meter (4.0 CFM per square foot) at 750 Pa (3 inch W.G.) differential pressure.

C. Minimum requirements for dampers:
   1. Shall comply with requirements of Table 6-1 of UL 555S, except for the Fire Endurance and Hose Stream Test.
   2. Frame: Galvanized steel channel with side, top and bottom stops or seals.
   3. Blades: Galvanized steel, parallel type preferably, 300 mm (12 inch) maximum width, edges sealed with neoprene, rubber or felt, if

required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for duct mounted dampers.

4. Shafts: Galvanized steel.
5. Bearings: Nylon, bronze sleeve or ball type.
6. Hardware: Zinc plated.
7. Operation: Automatic open/close. No smoke damper that requires manual reset or link replacement after actuation is acceptable. See drawings for required control operation.

D. Motor operator (actuator): Provide electric UL listed motor operator (actuator), externally mounted on stand-offs to allow complete insulation coverage.

2.6 FIRE DOORS

Galvanized steel, interlocking blade type, UL listing and label, 71 degrees C (160 degrees F) fusible link, 3 hour rating and approved for openings in Class A fire walls with rating up to 4 hours, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

2.7 FLEXIBLE CONNECTIONS

Where duct connections are made to fans and air handling units, install a non-combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to insure that no vibration is transmitted.

2.8 SOUND ATTENUATING UNITS

A. Hospital grade stainless steel high transmission loss casing with perforated metal inner lining and duct flanges. Sound attenuating units shall not contain any internal acoustic media.

B. Entire unit shall be completely air tight and free of vibration and buckling at internal static pressures up to 2000 Pa (8 inches W.G.) at operating velocities.

C. Pressure drop through each unit: Not to exceed indicated value at design air quantities indicated.

D. Submit complete independent laboratory test data showing pressure drop and acoustical performance. Product submittal shall include static pressure losses for initial and with system effect as designed.

E. Cap open ends of attenuators at factory with plastic, or other appropriate material to prevent entrance of dirt, water, or any other foreign matter to inside of attenuator. Caps shall not be removed until attenuator is installed in duct system.

2.9 PREFABRICATED DUCT AND EQUIPMENT ROOF CURBS

Extruded aluminum 300 mm (12 inches) above finish roof service, continuous welded corner seams, treated wood nailer, 40 mm (1-1/2 inch) thick, 48 kg/cubic meter (3 pound/cubic feet) density rigid mineral fiberboard insulation with metal liner, built-in cant strip (except for gypsum or tectum decks). For surface insulated roof deck, provide raised cant strip (recessed mounting flange) to start at the upper surface of the insulation. Curbs shall be constructed for pitched roof or ridge mounting as required to keep top of curb level. Size of curb shall be determined by manufacturer based on size and weight of supported item.

2.10 EQUIPMENT SUPPORTS

Refer to Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

2.11 FIRESTOPPING MATERIAL

Refer to Section 078400, FIRESTOPPING.

2.12 SEISMIC RESTRAINT FOR DUCTWORK

Refer to Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

2.13 THERMOMETER (AIR)

Refer to Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

2.14 INSTRUMENT TEST FITTINGS

A. Manufactured type with a minimum 50 mm (two inch) length for insulated duct, and a minimum 25 mm (one inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.

B. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil, cooling coil, and heat recovery unit.

2.15 AIR FLOW CONTROL VALVES (AFCV)

Refer to Section 233600, AIR TERMINAL UNITS.

2.16 AIR OUTLETS AND INLETS

Refer to Section 233700, Air Outlets and Inlets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with provisions of Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.

B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:

1. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties. Duct offsets and transition shall be minimized wherever possible.
2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II.
3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.
4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

C. Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.

D. Install fire dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test.

E. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.

F. Install smoke dampers in accordance with the manufacturer’s instructions.

G. Paint the inside of the branch duct to each diffuser, register or grille with flat black paint to reduce visibility.

H. Control Damper Installation:

1. Provide necessary blank-off plates required to install dampers that

are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.

2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

I. Air Flow Measuring Devices (AFMD): Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.

J. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.2 DUCT LEAKAGE TESTS AND REPAIR

A. Leak testing company shall be independent of the sheet metal company employed by General Contractor.

B. Ductwork leak test shall be performed for the entire air distribution supply, return, exhaust system Section by Section including fans, coils and filter Section designated as static pressure class 750 Pa (3 inch W.G.) and above. All supply ductwork less than 500 Pa (3 inch W.G) shall also be tested where there is no air terminal units employed in the system.

C. Test procedure, apparatus and report shall conform to SMACNA Leakage Test manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.

D. All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.

E. All tests shall be performed in the presence of the Resident Engineer and the Test and Balance agency. The Test and Balance agency shall measure and record duct leakage and report to the Resident Engineer and

identify leakage source with excessive leakage.

F. If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the Resident Engineer.

G. All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.

H. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

3.3 TESTING, ADJUSTING AND BALANCING (TAB)

Refer to Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.4 OPERATING AND PERFORMANCE TESTS

Refer to Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

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SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Fans for heating, ventilating and air conditioning.

B. Product Definitions: AMCA Publication 99, Standard l-66.

1.2 RELATED WORK

A. Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

C. Section 237300, INDOOR CENTRAL-STATION AIR HANDLING UNITS.

1.3 QUALITY ASSURANCE

A. Refer to paragraph, QUALITY ASSURANCE, in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Fans and power ventilators shall be listed in the current edition of AMCA 261, and shall bear the AMCA performance seal.

C. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).

D. Fans and power ventilators shall comply with the following standards:

1. Testing and Rating: AMCA 210.
2. Sound Rating: AMCA 300.

E. Vibration Tolerance for Fans and Power Ventilators: Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

F. Performance Criteria:

1. The fan schedule shows cubic meters per minute (CFM) and design static pressure. Scheduled fan motors, 0.37 kw (1/2 horsepower) and larger, are sized for design cubic meters per minute (CFM) at 110 percent design static pressure, but not to exceed 185 Pa (3/4-inch) additional pressure.
2. Provide fans and motors capable of stable operation at design conditions and at ll0 percent pressure as stated above.
3. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation a smaller motor may be approved in the interest of energy conservation.
4. Select fan operating point as follows:
   a. Forward curved and axial fans: Right hand side of peak pressure point.
   b. Airfoil, backward inclined or tubular: Near the peak of static efficiency.

G. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge exposed to operating and maintenance personnel.

H. Corrosion Protection:

1. Except for fans in fume hood exhaust service, all steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturers paint and paint system shall meet the minimum specifications of: ASTM D1735 water fog; ASTM B117 salt spray; ASTM D3359 adhesion; and ASTM G23 weathermeter.
2. Coating for fans in fume hood (H7 or H13) exhaust service: AMCA Standard preparation for coating 2601-66-2C33 finished with two coats of epoxy-ester, such as Carboline 110.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers Literature and Data:

1. Fan sections, motors and drives.
2. Centrifugal fans, motors, drives, accessories and coatings.
   a. Roof mounted high plume dilution blowers.

C. Sound power levels for each fan.

D. Maintenance and operating manuals in accordance with Section 010000, GENERAL REQUIREMENTS.

E. Fan curves for each fan showing cubic meters per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation and at ll0 percent of design static pressure. Include product application data to indicate the effect of capacity control devices such as inlet vane dampers on flow, pressure and Kw (horsepower).

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Moving and Control Association (AMCA):

99-86.....Standards Handbook
210-01.....Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
261-98.....Directory of Products Licensed to bear the AMCA Certified Ratings Seal - Published Annually
300-96.....Reverberant Room Method for Sound Testing of Fans

C. American Society for Testing and Materials (ASTM):
B117-03.....Standard Practice for Operating Salt Spray(Fog) Apparatus.
D1735-02.....Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
D3359-02.....Standard Test Method for Measuring Adhesion by Tape Test

D. Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA):
9-00.....Load Ratings and Fatigue Life for Ball Bearings

E. National Fire Protection Association (NFPA):
NFPA 96-02.....Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

F. National Sanitation Foundation (NSF):
37-02.....Air Curtains for Entrance Ways in Food and Food Service Establishments

G. Underwriters Laboratories, Inc. (UL)
181-96.....Factory made Air Ducts and Air Connectors

PART 2 - PRODUCTS

2.1 FAN SECTION (CABINET FAN):

Refer to Section 237300, INDOOR CENTRAL-STATION AIR HANDLING UNITS, for specifications.

2.2 CENTRIFUGAL FANS

A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE. Record factory vibration test results on the fan or furnish to the Contractor.

B. Fan arrangement, shall be as noted on the Contract Drawings.

C. Construction: Wheel diameters and outlet areas shall be in accordance with AMCA standards.

1. Housing: Low carbon steel, arc welded throughout, braced and supported by structural channel or angle iron to prevent vibration or pulsation, flanged outlet, inlet fully streamlined. Provide lifting clips, and casing drain. Provide manufacturer's standard access door. Provide 12.5 mm (1/2") wire mesh screens for fan inlets without duct connections.
2. Wheel: Steel plate with die formed blades welded or riveted in place, factory balanced statically and dynamically.

3. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.
4. Bearings: Heavy duty ball or roller type sized to produce a Bl0 life of not less than 40,000 hours, and an average fatigue life of 200,000 hours. Extend lubrication tubes for interior bearings or ducted units to outside of housing.
5. Motor, adjustable motor base, drive and guard: Furnish from factory with fan. Refer to Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, for specifications. Provide protective sheet metal enclosure for fans located outdoors.
6. Furnish variable speed fan motor controllers where shown on the drawings. Refer to Section, MOTOR STARTERS. Refer to Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, for controller/motor combination requirements.

2.3 UTILITY TYPE FUME HOOD EXHAUST FAN

A. Fan shall be a single width, single inlet, backward inclined flat blade, belt driven centrifugal vent set.
B. Fan shall be manufactured at an ISO 9001 certified facility listed by Underwriters Laboratories (UL/cUL 705). Fan shall bear the AMCA certified ratings seal for air performance.
C. The fan shall be of bolted and welded aluminum construction utilizing corrosion resistant fasteners. The entire fan housing shall have continuously welded seams for leakproof operation. The fan housing shall be field rotatable to any one of eight discharge positions and shall have a minimum 1-1/2 inch outlet discharge flange. Side access inspection ports shall be provided with quick release latches for access to the motor compartment without removing the weather cover. Lifting lugs shall be provided for ease of installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.
D. Steel fan components shall have an electrostatically applied, baked polyester powder coating with a minimum 2 mil thickness. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.
E. Wheel shall be aluminum centrifugal backward inclined, non-overloading flat blade type. Blades shall be continuously welded to the backplate and deep spun inlet shroud. Wheel hub shall be keyed and securely attached to the fan shaft.
F. Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure.

G. Bearings shall be heavy duty regreasable ball or roller type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

H. Blower shaft shall be Type 316 Stainless Steel accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum RPM.

I. Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM. Provide one set of factory belts and one complete replacement motor for attic stock.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fan, motor and drive in accordance with manufacturer's instructions.

B. Align fan and motor sheaves to allow belts to run true and straight.

C. Bolt equipment to curbs with galvanized lag bolts.

D. Provide necessary guy wires and anchors in accordance with manufacturer’s instructions.

3.2 PRE-OPERATION MAINTENANCE

A. Grease bearings.

B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

C. Clean fan interiors to remove foreign material and construction dirt and dust.

3.3 START-UP AND INSTRUCTIONS

A. Check vibration and correct as necessary for air balance work.

B. After air balancing is complete and permanent sheaves are in place perform necessary field mechanical balancing to meet vibration tolerance in Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

C. Verify proper operation of motor, drive system and fan wheel.

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SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Air terminal units, air flow control valves.

1.2 RELATED WORK

A. Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for equipment.

B. Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION: General mechanical requirements and items, which are common to more than one section of Division 23.

C. Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT: Noise requirements.

D. Section 233100, HVAC DUCTS AND CASINGS: Ducts and flexible connectors.

E. Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Valve operators.

F. Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC: Flow rates adjusting and balancing.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph QUALITY ASSURANCE, in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Air Terminal Units: Submit test data.
2. Air flow control valves.

C. Certificates:

1. Compliance with paragraph, QUALITY ASSURANCE.
2. Compliance with specified standards.

D. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 010000, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Conditioning and Refrigeration Institute (ARI):
880-98.....Air Terminals

C. National Fire Protection Association (NFPA):
90A-02.....Standard for the Installation of Air Conditioning and Ventilating Systems
70-05.....National Electrical Code

D. Underwriters Laboratories, Inc. (UL):
181-05.....Standard for Factory-Made Air Ducts and Air Connectors
1995-05.....Heating and Cooling Equipment

1.6 GUARANTY

In accordance with Section 00 72 00, GENERAL CONDITIONS.

PART 2 - PRODUCTS

2.1 AIR TERMINAL UNITS (BOXES)

A. General: Factory built, pressure independent units, factory set-field adjustable air flow rate, suitable for single duct applications, as indicated. Clearly show on each unit the unit number and factory set air volumes corresponding to the contract drawings. Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC work assume factory set air volumes. Coordinate flow controller sequence and damper operation details with the drawings and Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

B. Rating and Performance Certification: ARI Industry Standard 880.
   1. Maximum pressure drop: As shown on the drawings.
   2. Maximum room sound levels: Not to exceed criteria stated in Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT unless shown otherwise on drawings. Provide terminal sound attenuators where necessary to comply with the noise criteria. Sound tests and correction of deficiencies is specified in Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

C. Casing: Unit casing shall be constructed of galvanized steel not lighter than 0.85 mm (22 gauge). Provide hanger brackets for attachment of supports.
   1. Lining material: Suitable to provide required acoustic performance, thermal insulation and prevent sweating. Meet the requirements of NFPA 90A and comply with UL 181 for erosion. Insulation shall

consist of 13mm (1/2 IN) thick closed cell insulation of 4-lb/cu.ft, secured by full length galvanized steel z-strips which enclose and seal all edges. Tape and adhesives shall not be used. Comply with UL Standard l8l for erosion. Surfaces, shall be faced with perforated metal so that the air stream will not detach material. Insulation shall meet the 25/50 flame and smoke spread rating.

2. Access panels (or doors): Provide panels large enough for inspection, adjustment and maintenance without disconnecting ducts, and for cleaning heating coils attached to unit, even if there are no moving parts. Panels shall be insulated to same standards as the rest of the casing and shall be secured and gasketed airtight. It shall require no tool other than a screwdriver to remove.
3. Total leakage from casing: Not to exceed 2 percent of the nominal capacity of the unit when subjected to a static pressure of 747 pa (3 IN WG), with all outlets sealed shut and inlets fully open.

D. Construct dampers and other internal devices of corrosion resisting materials which do not require lubrication or other periodic maintenance.
   1. Damper Leakage: Not greater than 2 percent of maximum rated capacity, when closed against inlet static pressure of 1kPa (4-inch WG).

E. Provide multi-point velocity pressure sensors with external pressure taps.
   1. Provide direct reading air flow rate table pasted to box.

F. Provide static pressure tubes.

G. Factory calibrate air terminal units to air flow rate indicated. All settings including maximum and minimum air flow shall be field adjustable.

H. Provide sound attenuators where necessary to comply with the noise criteria. Attenuators to be as specified in Section 233100, HVAC DUCTS AND CASINGS.

I. Heating coils for air terminal units: ARI certified, continuous plate or spiral fin type, leak tested at 2070 kPa (300 PSI).
   1. Capacity: As indicated, based on scheduled entering water temperature.
   2. Headers: Copper or Brass.
   3. Fins: Aluminum, maximum 315 fins per meter (8 fins per IN).

4. Tubes: Copper, arrange for counter-flow of heating water.
5. Water velocity: 2.4 m/s (8 FPS) maximum with head loss not greater than indicated.
6. Provide vent and drain connection at high and low point, respectively of each coil.
7. Coils shall be guaranteed to drain.

J. Externally powered DDC variable air volume controller and damper actuator to be furnished under Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC for factory mounting on air terminal units.

2.2 AIR FLOW CONTROL VALVE (AFCV)

A. An airflow control system shall be furnished and installed to control the airflow into and out of critical environments and for hoods exhaust system. An airflow control system shall be rated to be the operating static pressures of the installed system. The control system shall vary the amount of make-up/supply air into the room to operate the laboratories at the lowest possible airflow rates necessary to maintain temperature control, achieve minimum ventilation rates, and maintain proper pressurization in relation to adjacent spaces (positive or negative).

B. The airflow control valve manufacturer shall receive hot water reheat coils from coil manufacturer. Air flow control valve manufacturer shall fabricate and install duct transitions from airflow control valve discharge to hot water heating coil casing dimensions. Factory-assembled unit shall be shipped to site as one component. Refer to Contract Documents for further details.

C. Provide sound attenuators where necessary to comply with the noise criteria and as shown in Contract Documents.

D. In strict accordance with this specification, alternative airflow control systems and equipment shall only be considered for approval provided that the equipment be equal in every respect to the operational characteristics, capacities, and intent of control sequences specified herein. Approval to bid does not relieve the airflow control system supplier from complying with the minimum requirements or intent of this specification.

E. The engineer and owner shall be the sole judges of quality and equivalence of equipment, materials, methods, and life cycle cost.

F. Preventive Maintenance

1. The airflow control system supplier shall provide at no additional cost to the owner during and after the warranty period, five years of required preventive maintenance on all airflow sensors (e.g., pitot tube, flow cross, orifice ring, air bar, hot wire, vortex shedder, side wall sensors, etc.), and flow transducers provided under this section. Airflow sensors shall be removed, inspected and cleaned annually during the five year period to prevent inaccuracies due to long term buildup from corrosion, wet or sticky particles, or other materials that foul the sensor. If duct mounted airflow sensors are provided, the airflow control system supplier shall include in the proposal the cost of supplying and installing duct access doors, one for each sensor. The transducer shall be checked and recalibrated annually to insure long term accuracy. Note that auto-zero recalibration of transducers is not acceptable as a substitute for annual recalibration.

G. Warranty Period

1. Warranty shall commence upon the date of shipment and extend for a period of thirty-six months whereupon any defects in materials or airflow control system performance shall be repaired by the supplier at no cost to the owner.

H. Airflow Control System Description

1. Refer to Contract Documents for actual quantities and locations of airflow control system.
2. The airflow control system shall maintain specific airflow (± 5% of signal within one second of a change in duct static pressure) regardless of the magnitude of the pressure change (within 0.6" to 3.0" wc), airflow change or quantity of airflow control devices on the manifold.
3. The airflow control system shall use volumetric offset control to maintain room pressurization. The system shall maintain proper room pressurization polarity (negative or positive) regardless of any change in room/system conditions, or rapid changes in duct static pressure. Systems using differential pressure measurement or velocity measurement to control room pressurization are unacceptable.

4. The airflow control system shall maintain specific airflow (± 5% of signal) with a minimum 16 to 1 turndown to insure accurate pressurization at low airflow and guarantee the maximum system diversity and energy efficiency.

I. Airflow Control Device - General

1. The airflow control device shall be a venturi valve with electric actuation. VAV boxes are unacceptable.
2. The airflow control device shall be pressure independent over its specified differential static pressure operating range. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controllers on a manifolded system.
3. The airflow control device shall maintain accuracy within ± 5% of signal over an airflow turndown range of no less than 16 to 1. No minimum entrance or exit duct diameters shall be required to ensure accuracy and/or pressure independence.
4. The airflow control device shall be constructed, as follows:
   a. The airflow control device for non-corrosive airstreams such as supply and exhaust shall be constructed of 316 stainless steel. The device's shaft and shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal mounting link shall be made of aluminum. The pressure independent springs shall be a spring grade stainless steel. All shaft bearing surfaces shall be made of a Teflon or Celenex composite.
5. Certification
   a. Each airflow control device shall be factory calibrated to the job specific airflows as detailed on the plans and specifications using NIST traceable air stations and instrumentation having a combined accuracy of at least ± 1% of signal over the entire range of measurement. Electronic airflow control devices shall be further calibrated and their accuracy verified to ± 5% of signal at a minimum of eight different airflows across the full operating range of the device.
   b. All airflow control devices shall be individually marked with device specific, factory calibration data. As a minimum, it should include: tag number, serial number, model number, eight

point characterization information (for electronic devices), and quality control inspection numbers. All information shall be stored by the manufacturer for use with as-built documentation.

6. Airflow control devices that are not venturi valves, and airflow measuring devices (e.g., pitot tube, flow cross, air bar, orifice ring, vortex shedder, etc.) shall only be acceptable provided they meet all the performance and construction characteristics as stated throughout this specification and:
   a. The airflow control device employs transducers manufactured by Rosemount, Bailey, Bristol, or Foxboro. Accuracy shall be no less than ± 0.15% of span (to equal ± 5% of signal with a 15 to 1 turndown) over the appropriate full scale range including the combined effects of nonlinearity, hysteresis, repeatability, drift over a one year period, and temperature effect. 316L stainless steel materials shall be provided for all exhaust applications. The use of 304 stainless steel materials shall be provided for all makeup air applications.
   b. Airflow sensors shall be of a multipoint averaging type, 304 stainless steel for all supply and general exhaust applications, 316L stainless steel for all fume hood, canopy, snorkel, and biosafety cabinet applications. Single point sensors are not acceptable.
   c. Suppliers of airflow control devices or airflow measuring devices requiring minimum duct diameters shall provide revised duct layouts showing the required straight duct runs upstream and downstream of these devices. Coordination drawings reflecting these changes shall be submitted by the supplier of the laboratory airflow control system. In addition, suppliers shall include static pressure loss calculations as part of their submittals. All costs to modify the ductwork, increase fan sizes and horsepower, and all associated electrical changes shall be borne by the laboratory airflow control supplier.
   d. Suppliers of duct mounted airflow measuring devices shall provide and install access doors at each airflow measuring device location.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Work shall be installed as shown and according to the manufacturer’s diagrams and recommendations.

B. Handle and install units in accordance with manufacturer's written instructions.

C. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

D. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls.

E. Insulate supply air flow control valves.

3.2 OPERATIONAL TEST

Refer to Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

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SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Air outlets and inlets, including the following:

1.2 RELATED WORK

A. Fume Hoods: Section 11 53 13, LABORATORY FUME HOODS.

B. Seismic Reinforcing: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

C. General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

D. Noise Level Requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

E. Testing and Balancing of Air Flows: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

1.3 QUALITY ASSURANCE

A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Fire Safety Code: Comply with NFPA 90A.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Diffusers, registers and accessories.

C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Diffusion Council Test Code:

1062 GRD-84.....Certification, Rating, and Test Manual 4th Edition

C. American Society of Civil Engineers (ASCE):

ASCE7-98.....Minimum Design Loads for Buildings and Other Structures

D. American Society for Testing and Materials (ASTM):

A167-99.....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A653-01.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process

A1011-02.....Standard Specification for Steel Sheet and Strip Hot rolled Carbon structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability

B209-01.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E84-01.....Standard Test Method for Surface Burning Characteristics of Building Materials

E. National Fire Protection Association (NFPA):

90A-99.....Standard for the Installation of Air Conditioning and Ventilating Systems

96-01.....Ventilation Control and Fire Protection of Commercial Cooking Operations

F. Underwriters Laboratories, Inc. (UL):

33-93.....UL Standard for Safety Heat Responsive Links for Fire Protection Service

PART 2 - PRODUCTS

2.1 AIR OUTLETS AND INLETS

A. Materials:

1. Aluminum, except that all units installed in labs and wet areas (see Article 2.3)shall be stainless steel. Provide manufacturer's standard gasket.
2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless steel.
3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.

B. Performance Test Data: In accordance with Air Diffusion Council Code 1062GRD. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT for NC criteria.

C. Refer to Contract Documents for further information.

D. Air Supply Outlets:
   1. Ceiling Diffusers: Suitable for surface mounting or exposed T-bar, off-white finish, square or round neck connection as shown on the drawings. Provide plaster frame for units in plaster ceilings. Provide 3” high square into round adapter on each diffuser as required.
      a. Square, louver, fully adjustable pattern: Round neck, surface mounting unless shown otherwise on the drawings. Provide equalizing or control grid and volume control damper.
      b. Louver face type: Square or rectangular, removable core for 1, 2, 3, or 4 way directional pattern. Provide equalizing or control grid and opposed blade damper.
   2. Laminar Flow Supply Diffusers:
      a. Devices shall consist of a non-aspirating perforated panel center air supply providing uni-directional downward airflow. Velocity of air distribution shall not exceed 15 m/min (50 feet per minute). Perforated pressure plates shall be provided over the perimeter and center air distribution faces to equalize pressure and airflow throughout the system. Refer to Contract Documents for further information.
   3. Registers: Double deflection type with horizontal face bars and opposed blade damper with removable key operator.
      a. Margin: Flat, 30 mm (1-1/4 inches) wide.
      b. Bar spacing: 20 mm (3/4 inch) maximum.
      c. Finish: Off white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded with manufacturer's standard finish.

E. Return and Exhaust Registers and Grilles: Provide opposed blade damper without removable key operator for registers.
   1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded aluminum with manufacturer's standard aluminum finish.
   2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 30 mm (1-1/4 inch) margin.
   3. Grid Core Type: 13 mm by 13 mm (1/2 inch by 1/2 inch) core with 30 mm (1-1/4 inch) margin.
   4. Lab: Stainless steel return registers, material and finish to match supply side.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.

B. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.

3.2 TESTING, ADJUSTING AND BALANCING (TAB)

Refer to Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.3 OPERATING AND PERFORMANCE TESTS

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION

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SECTION 23 40 00
HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Air filters for heating, ventilating and air conditioning.

B. Definitions: Refer to ASHRAE 52.1 for definitions of face velocity, net effective filtering area, media velocity, resistance (pressure drop), atmospheric dust spot efficiency and dust-holding capacity.

1.2 RELATED WORK

A. General mechanical requirements and items, which are common to more than one section of Division 23: Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Filter housing and racks: Section 237300, INDOOR CENTRAL-STATION AIR HANDLING UNITS.

C. Refer to ASHRAE Standard 52.2 for definitions of MERV and particle size ranges for each MERV number. ASHRAE Standard 52.2 measures particle size efficiency (PSE).

1.3 QUALITY ASSURANCE

A. Air Filter Performance Report for Extended Surface Filters:

1. Submit a test report for each Grade of filter being offered. The report shall be less than three (3) years old and prepared by an independent testing laboratory using test equipment, method and duct section as specified by ASHRAE Standards 52.1 and 52.2 for type filter under test and acceptable to Resident Engineer, indicating that filters comply with the requirements of this specification. Test for 150 m/min (500 fpm) will be accepted for lower velocity rated filters provided the test report of an independent testing laboratory complies with all the requirements of this specification.

B. Filter Supplier Warranty for Extended Surface Filters: Guarantee the filters against leak, blow-outs, and other deficiencies during their normal useful life. Defective filters shall be replaced at no cost to the Government.

C. Comply with UL Standard 586 for flame test.

D. Nameplates: Each filter shall bear a label or name plate indicating manufacturer's name, filter size, rated efficiency, UL classification, and file number.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA,

AND SAMPLES.

B. Manufacturer's Literature and Data:
   1. Extended surface filters.
   2. Holding frames. Identify locations.
   3. Side access housings. Identify locations, verify insulated doors.
   4. Magnehelic gages.

C. Air Filter performance reports.

D. Suppliers warranty.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc. (ASHRAE):

52.1-92.....Gravimetric and Dust-Spot procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter

52.2-99.....Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size

C. American Society of Mechanical Engineers (ASME):

NQA1-02.....Quality Assurance Requirements for Nuclear Facilities Applications

D. Underwriters Laboratories, Inc. (UL):

586-00.....High-Efficiency, Particulate, Air Filter Units

900-00.....Air Filter Units

PART 2 - PRODUCTS

2.1 REPLACEMENT FILTER ELEMENTS TO BE FURNISHED

A. To allow temporary use of HVAC systems for testing and in accordance with Paragraph, TEMPORARY USE OF MECHANICAL AND ELECTRICAL SYSTEMS in Section 010000, GENERAL REQUIREMENTS, provide one complete set of additional (replacement) filter elements.

B. The Resident Engineer will direct whether these additional filters will either be installed as replacements for dirty units or turned over to VA for future use as replacements.

2.2 EXTENDED SURFACE AIR FILTERS

A. Use factory assembled air filters of the extended surface type with supported or non-supported cartridges for removal of particulate matter in air conditioning, heating and ventilating systems. Filter units shall

be of the extended surface type fabricated for disposal when the dust-load limit is reached as indicated by maximum (final) pressure drop.

B. Filter Classification: UL approved Class 1 or Class 2 conforming to UL Standard 900.

C. Filter Grades, Percent, Average ASHRAE Efficiency and Controlled Containment:

1. Grade A: 90-95 after-filter, when handling 0.3 to 1.0 micron particles.
2. Grade D: 25-30 pre-filter, when handling 3.0 to 10.0 micron particles.

D. Filter Media:

1. Grade A Supported (Rigid Pleated) Type: Media shall be composed of high density glass fibers or other suitable fibers. Fastening methods used to maintain pleat shape, (metal backing or aluminum separators) shall be sealed in a proper enclosing frame to insure no air leakage for life of filter. Staples and stays are prohibited.
2. Grade D (Pleated) Type: Media shall be composed of synthetic/natural fibers. Media shall maintain uniform pleat shape and stability for proper air flow and maximum dust loading. The media frame shall be constructed of aluminized steel. Bond the pleated media pack on all four edges to insure no air leakage for the life of the filter. Staples and stays are prohibited.

E. Filter Efficiency and Arrestance: Efficiency and arrestance of filters shall be determined in accordance with ASHRAE 52.1 and MERV value in accordance with ASHRAE Standard 52.2. Atmospheric dust spot efficiency and synthetic dust weight arrestance shall not be less than the following:

	Percentage of Initial Efficiency	Percentage of Average Efficiency	Percentage of Average Arrestance	MERV Value
Grade A	75.4	86.4	99.0	14
Grade D	Less than 20.0	30.0	89.0	8

F. Maximum initial and final resistance, Pa (inches of water), for each filter cartridge when operated at 150 m/min (500 feet per minute) face velocity:

	Initial Resistance	Final Resistance
Grade A (Rigid Pleated)	185 (0.74)	300 (1.20)
Grade D (2-inch deep)	80 (0.32)	250 (1.0)

G. Minimum Media Area: The minimum net effective media area in square meter (square feet) for each 600 mm by 600 mm (24 inches by 24 inches) (face area) filter at 150 m/min (500 fpm) face velocity shall be at least the values listed below. For other filter sizes the net effective media area shall be proportionally higher or lower.

Grade A (Rigid Pleated), 300 mm (12 inch) deep	5.3 (57.0)
Grade D 50 mm (2 inch deep)	1.4 (14.8)

H. Side Servicing Housings:
1. Minimum 1.6 mm (16 gage) galvanized steel, completely factory assembled with upstream and downstream flanges for connection into the duct system. Furnish housing length sufficient to provide for fully extended operating filter elements.
2. Access doors: Double skin insulated, at each end of the housing with continuous gasketing on the perimeter and positive locking devices. Design doors to withstand a minimum positive/negative 1.0 kPa (four inches of water) static pressure.
3. Filter slide channels: Channels shall incorporate a positive-sealing gasket material to seal the top and bottom of the filter cartridge frames to prevent bypass. Provide factory installed gasketing to prevent leakage between cartridges, and between cartridges and doors.

I. Holding Frame System:
1. Minimum 1.6 mm (16 gage) galvanized steel, 100 mm (4 inches) deep, factory-supplied hardware necessary for field assembly, suitable for either upstream or downstream filter servicing. All members shall be cut to size and prepunched for easy assembly into modules of the size and capacity noted in the schedules.
2. The framing members shall be permanently gasketed to prevent the bypass of unfiltered air. If required, furnish suitable vertical support members to prevent deflection of horizontal members. The vertical support members shall not interfere with either the installation or operation of the filters.
3. The framing system shall incorporate a factory installed positive sealing device for each row of filters. This device shall allow for

easy installation and removal of cartridges and shall insure the seal between the gasketed filter elements while the bank is in operation.

J. Magnehelic Differential Pressure Filter Gages: Nominal 100 mm (four inch) diameter, zero to 500 Pa (zero to two inch water gage) range, flush mounted in aluminum panel board, complete with static tips, copper or aluminum tubing, and accessory items to provide zero adjustment. Provide one gage for each extended surface filter section. Provide Petcocks for each gauge.

K. Equipment Identification: Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

2.3 HEPA FILTERS

A. High Efficiency Particulate Air (HEPA) filters shall be individually tested and certified to be 99.97 percent minimum efficient meeting minimum MERV value of 17 when handling 0.3 micron or smaller particles in accordance with DOP test method. Filters shall be factory scanned. The DOP efficiency along with filter serial number and name of manufacturer shall be marked on the filter. HEPA filter shall have pressure drop as scheduled on the Contract Drawings.

B. Filter media: Factory constructed by pleating a continuous sheet of media into closely spaced pleats with kraft or aluminum separators. Sealer shall be self-extinguishing.

C. Enclosing frame shall be 16 gauge galvanized steel. Provide pre-filters in the same housing with a separate removal assembly that operates independently from the HEPA filters.

D. Pre-filter: Type D, 2 inches deep. See Paragraph 2.2.

E. Bag-In/Bag-Out Housing for HEPA Filters:

1. Housing shall be fabricated of 15 gauge type 304 stainless steel.
2. Housing shall be equipped with weather covers, drilled face flanges and factory mounted Magnehelic gauges with Petcocks housed in stainless steel brackets.
3. Housing shall be pressure tested in factory for high quality to withstand a positive or negative pressure of 10 inch WG. Perform a quantitative leakage and filter performance DOP (Dioctyl Phthalate Penetration) field test in addition to factory test at the initial installation, in the presence of the factory representative.
4. Housing shall incorporate a spring loaded clamping mechanism that is operated from outside and which is capable of exerting a 5340 N (1,200 lb.) sealing force across the top and bottom of each filter.

5. Housing shall have a bagging ring around the access port, sealed by a removable, gasketed access door. The bagging ring shall have two (2) continuous ribs to secure the plastic change-out bag and be hemmed on its outer edge to prevent the bag from tearing.
6. One 8 mil thick PVC change-out bag shall be supplied for each access door. The bag shall include approximately 300 mm (12 inches) of transparent PVC at the open end and three glove sleeves built into the body to assist in filter change-out. Bag-In/Bag-Out housings shall be manufactured under a quality assurance program that addresses the requirements of ASME NQA1, "Quality Assurance Requirements for Nuclear Facilities Applications."
7. Comply with U.L. Standard 586.

F. Equipment Identification: Section 230511, Common Work Results for HVAC and Steam Generation.

PART 3 - EXECUTION

3.1 INSTALLATION

Install supports, filters and gages in accordance with manufacturer's instructions.

3.2 START-UP AND TEMPORARY USE

A. Clean and vacuum air handling units, and plenums, exhaust fans, supply and exhaust ductwork to the satisfaction of the Resident Engineer prior to starting air handling systems, and exhaust systems.

B. Install or deliver replacement filter units as directed by the Resident Engineer.

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SECTION 23 73 00
INDOOR CENTRAL-STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Air handling units including integral components specified herein.

B. Definitions: Air Handling Unit (AHU): A factory fabricated assembly consisting of fan, coils, filters, and other necessary equipment to perform one or more of the following functions of cleaning, heating, and cooling of air. Design capacities of units shall be as scheduled on the drawings.

1.2 RELATED WORK

A. Seismic restraints for equipment: Section 130541, SEISMIC RESTRAINTS REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

B. General mechanical requirements and items, which are common to more than one section of Division 23: Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

C. Sound and vibration requirements: Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

D. Piping and duct insulation: Section 230711, HVAC, PLUMBING AND BOILER PLANT INSULATION.

E. Piping and valves: Section 232113, HYDRONIC PIPING, Section 232213, STEAM AND CONDENSATE HEATING PIPING.

F. Return and exhaust fans: Section 233400, HVAC FANS.

G. Requirements for flexible duct connectors, sound attenuators and sound absorbing duct lining, and air leakage: Section 233100, HVAC DUCTS AND CASINGS.

H. Air filters and filters' efficiency: Section 234000, HVAC AIR CLEANING DEVICES.

I. HVAC controls: Section 230923, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

J. Testing, adjusting and balancing of air and water flows: Section 230593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

K. Types of motor starters: Section 262911, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

A. Refer to Article, Quality Assurance, in Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Air Handling Units Certification: Certify air-handling units in accordance with ARI 430.

C. Heating, Cooling, and Air Handling Capacity and Performance Standards: ARI 430, ARI 410, ASHRAE 51, and AMCA 210.

D. Performance Criteria:

1. The fan schedule indicates design cubic meter per minute (cubic feet per minute) and design static pressure. Scheduled fan motors, 375 watts (1/2 horsepower) and larger, are sized for the maximum of design cubic meter per minute (cubic feet per minute) at 110 percent design static pressure, but not to exceed 187 Pa (3/4 inch water gage) additional pressure.
2. Fans and motors shall be capable of stable operation at design conditions cubic meters per minute (cubic feet per minute) and 110 percent pressure as stated above.
3. Select fan operating point to right hand side of peak static pressure point and near the peak of static efficiency.
4. Operating Limits: AMCA 99.

E. Units shall be constructed by a manufacturer who has been manufacturing air handling units for at least five (5) years.

F. Shipping splits shall be provided for installation. Lifting lugs shall be supplied on each side of the split to facilitate rigging and joining of segments. Each piece shall be shipped in shrink wrapping to protect the unit from dirt and moisture.

1.4. SUBMITTALS:

A. The contractor shall, in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish a complete submission for all air handling units covered in the project. The submission shall include all information listed below. Partial and incomplete submissions shall be rejected without reviews.

B. Manufacturer's Literature and Data:

1. Submittals for AHUs shall include fans, drives, motors, coils, filter housings, and all other related accessories. The contractor shall provide custom drawings showing total air handling unit assembly including dimensions, operating weight, access sections, diffusion plates, flexible connections, door swings, controls penetrations, wiring, utility connection points, unit support system, vibration isolators, drain pan, pressure drops through each component (filter, coil etc) and rigging points. Submittal drawings of section or component only, will not be acceptable. Contractor shall also submit performance data including performance test results, charts, curves or certified computer selection data; data sheets; fabrication and

insulation details; and the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements. This data shall be submitted in hard copies and in electronic version compatible to AutoCAD version used by the VA at the time of submission.

2. Submit sound power levels in each octave band for fan and at entrance and discharge of AHUs at scheduled conditions. Include sound attenuator capacities and itemized internal component attenuation. Internal lining of supply air ductwork with sound absorbing material is not permitted. In absence of sound power ratings refer to Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
3. Provide fan curves showing cubic meters per minute (cubic feet per minute), static pressure, efficiency, and horsepower for design point of operation and at maximum design cubic meters per minute (cubic feet per minute) and 110 percent of design static pressure.
4. Submit total fan static pressure, external static pressure, for AHU including total, inlet and discharge pressures, and itemized specified internal losses and unspecified internal losses. Refer to air handling unit schedule on drawings.

C. Maintenance and operating manuals in accordance with Section 010000, GENERAL REQUIREMENTS. Include instructions for lubrication, filter replacement, motor and drive replacement, spare part lists, and wiring diagrams.

D. Submit written test procedures two weeks prior to factory testing. Submit written results of factory tests for approval prior to shipping.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air-Conditioning and Refrigeration Institute (ARI):

260-01.....Sound Rating of Ducted Air Moving and Conditioning Equipment

410-01.....Standard for Forced-Circulation Air-Heating and Air-Cooling Coils

430-89.....Standard for Central Station Air Handling Units

ARI-DCAACP.....Directory of Certified Applied Air Conditioning Products

C. Air Moving and Conditioning Association (AMCA):

210-00.....Laboratory Methods of Testing Fans for Rating

D. Anti-Friction Bearing Manufacturer's Association, Inc. (AFBMA):
9-90.....Load Ratings and Fatigue life for Ball Bearings

E. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
51-01.....Standard, Laboratory Methods of Testing Fans for Rating

F. American Society for Testing and Materials (ASTM):
A653/653M-02.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
B117-97.....Salt Spray (Fog) Testing
C1071-00.....Thermal and Acoustical Insulation (Mineral Fiber, Duct Lining Material)
D1654-00.....Standard Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
D1735-97.....Water Resistance of Coatings Using Water Fog Apparatus
D3359-95.....Standard Test Methods for Measuring Adhesion by Tape Test
E84-01.....Surface Burning Characteristics of Building Materials

F. Anti-Friction Bearing Manufacturer's Association, Inc. (AFBMA):
9-90.....Load Ratings and Fatigue life for Ball Bearings

G. Military Specifications (Mil. Spec.):
DOD-P-21035A-77.....Paint, High Zinc Dust Content, Galvanizing Repair

H. National Fire Protection Association (NFPA):
90A-99.....Installation of Air Conditioning and Ventilating Systems

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS

A. General:

1. AHUs shall be entirely of double wall galvanized steel construction. Casing is specified in paragraph 2.1.C. Foil face lining is not an acceptable substitute for double wall construction. Galvanizing shall be hot dipped conforming to ASTM A525 and shall provide a minimum of 0.275 kg of zinc per square meter (0.90 oz. of zinc per square foot) (G90).

2. The contractor and the AHU manufacturer shall be responsible for insuring that the unit will not exceed the allocated space shown on the drawings, including required clearances for service and future overhaul or removal of unit components. All structural, piping, wiring, and ductwork alterations of units, which are dimensionally different than those specified, shall be the responsibility of the contractor at no additional cost to the government.
3. AHUs shall be fully assembled by the manufacturer in the factory in accordance with the arrangement shown on the drawings. The unit shall be assembled into the largest sections possible subject to shipping and rigging restrictions. The correct fit of all components and casing sections shall be verified in the factory for all units prior to shipment. All units shall be fully assembled, tested and then split to accommodate shipment and job site rigging. On units not shipped fully assembled, the manufacturer shall tag each section and include air flow direction to facilitate assembly at the job site. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.
4. The AHU manufacturer shall provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly. The manufacturer shall provide a local representative at the job site to supervise the assembly and to assure the units are assembled to meet manufacturer's recommendations and requirements noted on the drawings. Provide documentation that this representative has provided this service on similar jobs to the Contracting Officer. If a local representative cannot be provided, the manufacturer shall provide a factory representative.
5. Gaskets: All door and casing and panel gaskets and gaskets between air handling unit components, if joined in the field, shall be high quality which seal air tight and retain their structural integrity and sealing capability after repeated assembly and disassembly of bolted panels and opening and closing of hinged components. Bolted sections may use a more permanent gasketing method provided they are not disassembled.
6. Structural Rigidity: Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed 1/200 of the span based on a differential static pressure of 1991 Pa (8 inches water gage) or higher.

B. Base:

1. Provide a heavy duty steel base for supporting all AHU major

components. Bases shall be constructed of wide-flange steel I-beams, channels, or minimum 125 mm (5 inch) high 3.5 mm (10 gauge) steel base rails. Welded or bolted cross members shall be provided as required for lateral stability.

2. AHUs shall be completely self supporting for installation on concrete housekeeping pad.
3. The AHU bases shall be constructed of galvanized material.

C. Casing (including wall, floor and roof):

1. General: AHU casing shall be entirely double wall insulated panels, integral of or attached to a structural frame. Construction shall be such that removal of any panel shall not affect the structural integrity of the unit. Casing finished shall meet ASTM B117 125-hour or better salt-spray test (5 percent solution). All casing and panel sections shall be tightly butted and gasketed. No gaps of double wall construction will be allowed where panels bolt to air handling unit structural member.
2. Double wall galvanized steel panels shall be minimum 51 mm (2 inches) thick, constructed of minimum 16 gauge outer skin and 18 gauge solid inner skin. Perforated panels (inner skin) are not allowed in cooling coil sections, floors, door panels and where solid sheet is required to avoid air bypass. Casings of these sections must be without perforations and shall be same gauge thickness as specified above. Perforated panels and mylar between panels and insulation shall be provided in fan section.
3. Blank-Off: Provide where required to insure no air bypass between sections, through perforated panels or around coils or filters. Blank-Off shall be installed at each component of the air handling unit and also at the internal panels to prevent recirculation of the air through perforated panels. Seal any holes where bypass occurs.
4. Insulation: High density, insulation shall be encased in double-wall casing between exterior and interior panels such that no insulation can erode to the air stream. Insulation shall be 50 mm (2 inch) thick, 24 kg/m^3 and (1.5 lb/ft^3) with a thermal conductivity R of approximately 13.8 W/m.K (8.0 BTU/hr-ft^2 ^{0}F). Air handling units with less than 50 mm (2 inch) of insulation in any part of the walls, floor, structural channels, roof or drain pan shall not be acceptable. The insulation shall comply with NFPA 90-A for the flame and smoke generation requirements. Also, refer to specification Section 230711, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

5. Casing panels shall be secured to the support structure with stainless steel or zinc-chromate plated screws and gaskets installed around the panel perimeter. Panels shall be completely removable to allow removal of fan, coils, and other internal components for future maintenance, repair, or modifications. Welded exterior panels are not acceptable.
6. Access Doors: Provide in each access section and where shown on drawings. Doors shall be a minimum of 50 mm (2 inches) thick with same double wall construction as the unit casing. Doors shall be a minimum of 600 mm (24 inches) wide, unless shown of different size on drawings, and shall be the full casing height up to a maximum of 1850 mm (6 feet). Doors shall be gasketed, hinged, and latched to provide an airtight seal. The access doors for fan section, coil section shall include a minimum 150 mm x 150 mm (6 inch x 6 inch) double thickness, with air space between the glass panes tightly sealed, reinforced glass or Plexiglas window in a gasketed frame.
   a. Hinges: Manufacturers standard, designed for door size, weight and pressure classifications. Hinges shall hold door completely rigid with minimum 45 kg (100 pound) weight hung on latch side of door.
   b. Latches: Non-corrosive alloy construction, with operating levers for positive cam action, operable from either inside or outside. Doors shall open against unit operating pressure. Latch shall be capable of restraining explosive opening of door with a force not less than 1991 Pa (8 inches water gage).
   c. Gaskets: Neoprene, continuous around door, positioned for direct compression with no sliding action between the door and gasket. Secure with high quality mastic to eliminate possibility of gasket slipping or coming loose.
7. Provide sealed sleeves, metal or plastic escutcheons or grommets for penetrations through casing for power and temperature control wiring. Coordinate with electrical and temperature control subcontractors for number and location of penetrations. All penetrations and equipment mounting may be provided in the factory or in the field. All field penetrations shall be performed neatly by drilling or saw cutting. No cutting by torches will be allowed. Neatly seal all openings airtight.

D. Floor:
1. Unit floor shall be level without offset space or gap and designed to support a minimum of 200 pounds per square foot distributed load

without permanent deformation or crushing of internal insulation. Provide adequate structural base members beneath floor in service access sections to support typical service foot traffic and to prevent damage to unit floor or internal insulation. Unit floors in casing sections, which may contain water or condensate, shall be watertight with drain pan.

2. Where indicated, furnish and install floor drains, flush with the floor, with nonferrous grate cover and stub through floor for external connection.

E. Condensate Drain Pan: Drain pan shall be designed to extend entire length of cooling coils including headers and return bends. Depth of drain pan shall be at least 43 mm (1.7 inches) and shall handle all condensate without overflowing. Drain pan shall be of double wall construction of 304 stainless steel and have a minimum of 50 mm (2 inch) insulation, and shall be sloped to drain. Drain pan shall be continuous metal or welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be placed on top of casing floor or integrated into casing floor assembly. Drain pan shall be pitched in all directions to drain line.

1. An intermediate condensate drip pan shall be provided on stacked cooling coils and shall be constructed of 304 stainless steel with copper downspouts factory piped to main condensate pan.
2. Drain pan shall be piped to the exterior of the unit. Drain pan shall be readily cleanable.
3. Installation, including frame, shall be designed and sealed to prevent blow-by.

F. Fans Sections:

1. Fans shall be minimum Class II construction, double width, double inlet centrifugal, air foil, backward inclined or forward curved type as indicated on drawings, factory balanced and rated in accordance with AMCA 210 or ASHRAE 51. Provide self-aligning, pillow block, regreasable ball-type bearings selected for an L(50) average fatigue life of 200,000 hours per AFBMA Standard 9. Extend bearing grease lines to motor and drive side of fan section. Fan shall be located in airstream to assure proper air flow.
2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed.

After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, and Section 230593, TESTING, ADJUSTING AND BALANCING FOR HVAC.

G. Fan Motor, Drive and Mounting Assembly:

1. Provide internally vibration isolated fan, motor and drive using 2″ springs with seismic restraints and mounted on a common integral bolted or welded structural steel base with adjustable motor slide rail with locking device. Provide vibration isolators and flexible duct connections at fan discharge to completely isolate fan assembly. Refer to Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC, PIPING, AND EQUIPMENT, for additional requirements.
2. Fan Motor and Drive: Motors shall be premium efficient type and suitable for use in variable frequency drive applications on AHUs where this type of drive is indicated. Refer to Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, for additional motor and drive specifications. Where variable speed drives are required they shall be compatible with fan and motor. Refer to Specification Section 262911, LOW-VOLTAGE MOTOR STARTERS.
3. Fan drive and belts shall be factory mounted with final alignment and belt adjustment to be made by the Contractor after installation. Drive and belts shall be as specified in section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION. Provide additional drive(s) if required during balancing, to achieve desired airflow.

H. Filter Section: Refer to section 234000, HVAC AIR CLEANING DEVICES, for filter requirements.

1. Filters including one complete set for temporary use at site shall be provided independent of the AHU. The AHU manufacturer shall install filter housings and racks in filter section compatible with filters furnished. The AHU manufacturer shall be responsible for furnishing temporary filters (pre-filters and after-filters, as shown on drawings) required for AHU testing.
2. Factory-fabricated filter section shall be of the same construction and finish as the AHU casing including filter racks and hinged double wall access doors. Filter housings shall be constructed in accordance with side service or holding frame housing requirements in Section 234000, HVAC AIR CLEANING DEVICES.

I. Coils:

1. General Requirements For Coil Section: Comply with ARI 410.
2. Coil casing shall be constructed of 16 gauge galvanized steel with

aluminum die-formed corrugated fins.

3. Drainable water coils shall be designed to operate at 250 psig design working pressure and up to 300°F and shall be tested with 325 psig compressed air under water.
4. Seismic Fabrication Requirements: Fabricate coil section, internal mounting frame and attachment to coils, and other coil section components with reinforcement strong enough to withstand seismic forces defined in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, when coil-mounting frame and air handling unit mounting frame are anchored to building structure.
5. Coils shall be mounted on hot dipped galvanized steel supports to assure proper anchoring of coil and future maintenance. Coils shall be face or side removable for future replacement thru the access doors or removable panels. Each coil shall be removable without disturbing adjacent coil. Cooling coils shall be designed and installed to insure no condensate carry over. Provide factory installed extended supply, return, drain and vent piping connections. Refer to Drawings for additional coil requirements.

J. Sound Attenuators: Refer to Drawings, Specification Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, and Section 233100, HVAC DUCTS AND CASINGS, for additional unit mounted sound attenuator requirements.

K. Discharge Section: Provide aerodynamically designed framed discharge openings or spun bellmouth fittings to minimize pressure loss.

L. Electrical and Lighting: Wiring and equipment specifications shall conform to Division 26, Electrical.

1. Disconnect switch shall be by Division 26.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air handling unit in conformance with ARI 435.

B. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas with paint in accordance with Military Spec. DOD-P-21035. Repair painted units by touch up of all scratches with finish paint material. Vacuum the interior of air handling units clean prior to operation.

C. Leakage and test requirements for air handling units shall be the same as specified for ductwork in Specification Section 233100, HVAC DUCTS AND CASINGS, except leakage shall not exceed Leakage Class (C_L) 12 listed in SMACNA HVAC Air Duct Leakage Test Manual when tested at 1.5

times the design static pressure. Repair casing air leaks that can be heard or felt during normal operation and to meet test requirements.

D. Perform field mechanical (vibration) balancing in accordance with Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

E. Seal and/or fill all openings between the casing and AHU components and utility connections to prevent air leakage or bypass.

3.2 STARTUP SERVICES

A. A factory-trained service representative of the manufacturer shall supervise the unit startup and application specific calibration of control components. Report results in writing.

B. The air handling unit shall not be operated for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings are lubricated and fan has been test run under observation.

C. After the air handling unit is installed and tested, provide startup and operating instructions to VA personnel.

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SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

Radiant ceiling panels for heating applications.

1.2 RELATED WORK

A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for equipment.

B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION: General mechanical requirements and items, which are common to more than one section of Division 23.

C. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT: Noise requirements.

D. Section 23 21 13, HYDRONIC PIPING: Heating hot water and chilled water piping.

E. Section 23 31 00, HVAC DUCTS AND CASINGS: Ducts and flexible connectors.

F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Valve operators.

G. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC: Flow rates adjusting and balancing.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Radiant ceiling panels.

D. Certificates:

1. Compliance with paragraph, QUALITY ASSURANCE.
2. Compliance with specified standards.

E. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Conditioning and Refrigeration Institute (ARI):
440-05.....Room Fan Coils

C. National Fire Protection Association (NFPA):
90A-02.....Standard for the Installation of Air Conditioning and Ventilating Systems
70-05.....National Electrical Code

D. Underwriters Laboratories, Inc. (UL):
181-05.....Standard for Factory-Made Air Ducts and Air Connectors
1995-05.....Heating and Cooling Equipment

1.6 GUARANTEE

In accordance with FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 RADIANT CEILING PANELS: LINEAR TYPE

A. The radiant ceiling panels shall be extruded radiant panels, consisting of an aluminum face plate, copper tubes, and insulating blanket. The face plate shall consist of extruded aluminum sections not less than 3.0 mm (0.115 inch) thick, with interlocking edges and cross brace sections permanently locked together, to form one unitized panel. Copper tubes shall be minimum 10 mm (3/8 inches) diameter, ASTM B88, Type L or ASTM B280, copper tubing continuously attached to aluminum plate. The manufacturer is cautioned that the use of adhesive and/or clips to attach the copper to the extrusion may pull apart thus causing the manufacturer to replace and install the panels at no additional cost to the VA, since the ratings/or capacities will decrease under this condition. Capacities of the panels shall be as called for in the Contract Documents. Panels shall be finished in a standard manufacturer’s color as selected by the Architect and the Contracting Officer.

B. Radiant ceiling panel suspension accessories:

1. Anchors, fasteners, hooks, eveybolts, and other hanger attachment devices designed for fastening to building construction for support

of radiant ceiling panels shall be sized for maximum loads that may be transmitted by the completed ceiling system

2. Hanger wire shall be not less than 2.7 mm (12 gauge), galvanized soft-annealed, steel wire.
3. Provide panel security clips to lock panel in place. Wall molding shall be channel shaped with rigid metal blocking installed in channel to hold panel securely in place. All clips and hold downs shall be treated for rust resistance. Each hanger shall be stiff legged to prevent upward movement.

C. Exposed Lay-in Type Radiant Panel System:

1. Conform to ASTM C635.
2. Main Tees: Heavy duty not less than 0.5 mm (0.020 inch) thick steel.
3. Cross-Tees: 1200 mm (4 feet) cross tees shall be formed to fit into accommodating openings in main tee and spaced as required.
4. Tee Intersections: Intersections with edge molding shall be installed so tees will be flush with exposed edge molding.
5. Wall of Edge Molding: Designed for flush tee applications.

D. Runout and interconnecting piping:

1. Copper Tube:
   a. Interconnecting Piping: ASTM B-88, Soft Drawn Type M, minimum 3/8″ pipe size.
   b. Runout Piping: ASTM B-88, Hard Drawn Type L, size as indicated on Drawings.
2. Solder: ASTM B-32 (95 TA), 95-5 tin-antimony.
3. Interconnecting Piping Length: Sufficient to allow for expansion, contraction and removal for access. Provide a minimum of 2 m (6 feet) between panels of exposed lay in systems. Length may be reduced where access is available through adjacent panels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Work shall be installed as shown and according to the manufacturer’s diagrams and recommendations.

B. Handle and install units in accordance with manufacturer's written instructions.

C. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as

necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

D. Install 1″ thick fiberglass blanket insulation above hydronic radiant panels.

3.2 OPERATIONAL TEST

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

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SECTION 23 82 16
AIR COILS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Heating and cooling coils for air handling unit and duct applications.

1.2 RELATED WORK

A. Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Section 237300, INDOOR CENTRAL-STATION AIR HANDLING UNITS.

C. Reheat coils for VAV/CAV terminals: Section 233600, AIR TERMINALS UNITS.

1.3 QUALITY ASSURANCE

A. Refer to paragraph, QUALITY ASSURANCE, Section 230511, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

B. Unless specifically exempted by these specifications, heating and cooling coils shall be tested, rated, and certified in accordance with ARI Standard 4l0 and shall bear the ARI certification label.

1.4 SUBMITTALS

A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data for Heating and Cooling Coils: Submit type, size, arrangements and performance details. Present application ratings in the form of tables, charts or curves.

C. Provide installation, operating and maintenance instructions.

D. Certification Compliance: Evidence of listing in current ARI Directory of Certified Applied Air Conditioning Products.

E. Coils may be submitted with Section 237300, INDOOR CENTRAL-STATION AIR HANDLING UNITS.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Conditioning and Refrigeration Institute (ARI):
Directory of Certified Applied Air Conditioning Products
ARI 4l0-02.....Forced-Circulation Air-Cooling Air-Heating Coils.

C. American Society for Testing and Materials (ASTM):
B75/75M-02.....Seamless Copper Tube (Metric)

D. National Fire Protection Association (NFPA):
70-05.....National Electric Code

E. National Electric Manufacturers Association (NEMA):
250-03.....Enclosures for Electrical Equipment (1,000 Volts Maximum)

F. Underwriters Laboratories, Inc. (UL):
1996-01.....Electric Duct Heaters

PART 2 - PRODUCTS

2.1 HEATING AND COOLING COILS

A. Conform to ASTM B75 and ARI 410.

B. Tubes: Minimum 16 mm (0.625 inch) tube diameter; Seamless copper tubing.

C. Fins: 0.1397 mm (0.0055 inch) aluminum or 0.1143 mm (0.0045 inch) copper mechanically bonded or soldered or helically wound around tubing.

D. Headers: Copper, welded steel or cast iron. Provide seamless copper tubing or resistance welded steel tube for volatile refrigerant coils.

E. "U" Bends, Where Used: Machine die-formed, silver brazed to tube ends.

F. Coil Casing: 1.6 mm (l6 gage) galvanized steel with tube supports at 1200 mm (48 inch) maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.

G. Pressures kPa (PSIG):

Pressure	Water Coil	Steam Coil	Refrigerant Coil
Test	2070 (300)	1725 (250)	2070 (300)
Working	1380 (200)	520 (75)	1725 (250)

H. Protection: Unless protected by the coil casing, provide cardboard, plywood, or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.

I. Vents and Drain: Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing.

J. Cooling Coil Condensate Drain Pan: Section 237300, INDOOR CENTRAL-STATION AIR HANDLING UNITS.

2.2 REHEAT COILS, DUCT MOUNTED

A. Continuous circuit booster type for hot water as shown on drawings. Material of coils same as noted in Article 2.1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow coil manufacturer's instructions for handling, cleaning, installation and piping connections.

B. Comb fins, if damaged. Eliminate air bypass or leakage at coil sections.

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SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, applies to all sections of Division 26.

B. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchboards, panelboards, and other items and arrangements for the specified items are shown on drawings.

C. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

A. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.

B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed; equipment or device of a kind mentioned which:

   a. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.

b. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

2. Labeled; equipment or device is when:
   a. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
   b. The laboratory makes periodic inspections of the production of such equipment.
   c. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
3. Certified; equipment or product is which:
   a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
   b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
   c. Bears a label, tag, or other record of certification.
4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:
   1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
   2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the VA through the Contracting Officer Technical Representative (COTR) a minimum of 15 working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the COTR prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the Contractor shall be liable for all additional expenses, including expenses of the Government.

1.6 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with Section 00 72 00, GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.7 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
2. Damaged equipment shall be, as determined by the COTR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
3. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.8 WORK PERFORMANCE

A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
   1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
   2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.
   3. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the COTR and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways.
   4. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Director of the Medical Center.

D. For work on existing stations, arrange, phase and perform work to assure electrical service for all other areas of the building at all times.

Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interferences. See Section 00 72 00, GENERAL CONDITIONS.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces shall not be less than specified in the NEC for all voltages specified.

C. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.10 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, and control devices and other significant equipment.

B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4 inch) high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.11 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or

installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of

each subcontractor installing the system or equipment and the local representatives for the system or equipment.

3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation and maintenance instructions.
   e. Safety precautions.
   f. Diagrams and illustrations.
   g. Testing methods.
   h. Performance data.
   i. Lubrication schedule including type, grade, temperature range, and frequency.
   j. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
   k. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

G. Approvals will be based on complete submission of manuals together with shop drawings.

H. After approval and prior to installation, furnish the COTR with one sample of each of the following:
   1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
   2. Each type of conduit coupling, bushing and termination fitting.
   3. Conduit hangers, clamps and supports.
   4. Duct sealing compound.
   5. Each type of receptacle, toggle switch, outlet box, manual motor starter, device plate, engraved nameplate, wire and cable splicing and terminating material and single pole molded case circuit breaker.
   6. Each type of light fixture specified in Section 26 51 00, INTERIOR LIGHTING or shown on the drawings.

1.12 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.13 TRAINING

A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Training shall be provided for the particular equipment or system as required in each associated specification.

C. A training schedule shall be developed and submitted by the Contractor and approved by the COTR at least 30 days prior to the planned training.

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SECTION 26 05 21
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.2 RELATED WORK

A. Sealing around penetrations to maintain the integrity of time rated construction: Section 07 84 00, FIRESTOPPING.

B. General electrical requirements that are common to more than one section in Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

C. Conduits for cables and wiring: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

D. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.3 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

1. Manufacturer's Literature and Data: Showing each cable type and rating.
2. Certificates: Two weeks prior to final inspection, deliver to the Contracting Officer Technical Representative (COTR) four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.

B. American Society of Testing Material (ASTM):

D2301-04.....Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

C. Federal Specifications (Fed. Spec.):

A-A-59544-00.....Cable and Wire, Electrical (Power, Fixed Installation)

D. National Fire Protection Association (NFPA):
   70-05.....National Electrical Code (NEC)
E. Underwriters Laboratories, Inc. (UL):
   44-02.....Thermoset-Insulated Wires and Cables
   83-03.....Thermoplastic-Insulated Wires and Cables
   467-01.....Electrical Grounding and Bonding Equipment
   486A-01.....Wire Connectors and Soldering Lugs for Use with Copper Conductors
   486C-02.....Splicing Wire Connectors
   486D-02.....Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations
   486E-00.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
   493-01.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
   514B-02.....Fittings for Cable and Conduit
   1479-03.....Fire Tests of Through-Penetration Fire Stops

PART 2 - PRODUCTS

2.1 CABLE AND WIRE (POWER AND LIGHTING)

A. Cable and Wire shall be in accordance with Fed. Spec. A-A-59544, except as hereinafter specified.
B. Single Conductor:
   1. Shall be annealed copper.
   2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.
   3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.
C. Insulation:
   1. THW, XHHW, or dual rated THHN-THWN shall be in accordance with UL 44, and 83.
   2. Isolated power system wiring: Type XHHW with a dielectric constant of 3.5 or less.
D. Color Code:
   1. Secondary service, feeder and branch circuit conductors shall be color coded as follows:

208/120 volt	Phase	480/277 volt
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

a. The lighting circuit “switch legs” and 3-way switch “traveling wires” shall have color coding unique and distinct (i.e. pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Field coordinate for a final color coding with the COTR.

2. Use solid color compound or solid color coating for No. 12 AWG and No. 10 AWG branch circuit conductors and neutral sizes.
3. Phase conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
   a. Solid color compound or solid color coating.
   b. Stripes, bands, or hash marks of color specified above.
   c. Color as specified using 19 mm (3/4 inch) wide tape. Apply tape in half overlapping turns for a minimum of 75 mm (three inches) for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Color code for isolated power system wiring shall be in accordance with the NEC.

2.2 SPLICES AND JOINTS

A. In accordance with UL 486A, C, D, E and NEC.

B. Branch circuits (No. 10 AWG and smaller):
   1. Connectors: Solderless, screw-on, reusable pressure cable type, 600 volt, 105 degree C with integral insulation, approved for copper conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped wires.

3. The number, size, and combination of conductors, as listed on the manufacturers packaging shall be strictly complied with.

C. Feeder Circuits:

1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material.
2. Field installed compression connectors for cable sizes 250 kcmil and larger shall have not less than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.
4. Plastic electrical insulating tape: ASTM D2304 shall apply, flame retardant, cold and weather resistant.

2.3 CONTROL WIRING

A. Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 14 AWG.

B. Control wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

2.4 WIRE LUBRICATING COMPOUND

A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

B. Shall not be used on wire for isolated type electrical power systems.

2.5 FIREPROOFING TAPE

A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.

C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.

E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install in accordance with the NEC, and as specified.

B. Install all wiring in raceway systems, except where HCF Type AC cables are used.

C. Splice cables and wires only in outlet boxes, junction boxes, pull boxes.

D. Wires of different systems (i.e. 120V, 277V) shall not be installed in the same conduit or junction box system.

E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

F. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.

G. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.

H. Wire Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
2. Use ropes made of nonmetallic material for pulling feeders.
3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COTR.
4. Pull in multiple cables together in a single conduit.

I. No more than (3) single-phase branch circuits shall be installed in any one conduit.

J. The wires shall be derated in accordance with NEC Article 310. Neutral wires, under conditions defined by the NEC, shall be considered current-carrying conductors.

3.2 SPLICE INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

3.3 CONTROL AND SIGNAL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.

B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.

C. Where separate power supply circuits are not shown, connect the systems to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

E. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

3.4 CONTROL AND SIGNAL SYSTEM IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

3.5 FEEDER IDENTIFICATION

A. In each interior pullbox and junction box, install metal tags on each circuit cables and wires to clearly designate their circuit identification and voltage.

3.6 EXISITING WIRING

Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

3.7 FIELD TESTING

A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.

B. Tests shall be performed by megger and conductors shall test free from short-circuits and grounds.

C. Test conductor phase-to-phase and phase-to-ground.

D. The Contractor shall furnish the instruments, materials, and labor for these tests.

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies general grounding and bonding requirements of electrical equipment operations and to provide a low impedance path for possible ground fault currents.

B. “Grounding electrode system” refers to all electrodes required by NEC, as well as including made and supplementary grounding electrodes.

C. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include the location of system grounding electrode connections and the routing of grounding electrode conductors.

C. Test Reports: Provide certified test reports of ground resistance.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Contracting Officer Technical Representative (COTR):

1. Certification that the materials and installation is in accordance with the drawings and specifications.
2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the

extent referenced. Publications are referenced in the text by the basic designation only.

A. American Society for Testing and Materials (ASTM):

B1-2001.....Standard Specification for Hard-Drawn Copper Wire

B8-2004.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-1983.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

C. National Fire Protection Association (NFPA):

70-2005.....National Electrical Code (NEC)

99-2005.....Health Care Facilities

D. Underwriters Laboratories, Inc. (UL):

44-2005 .....Thermoset-Insulated Wires and Cables

83-2003 .....Thermoplastic-Insulated Wires and Cables

467-2004 .....Grounding and Bonding Equipment

486A-486B-2003 .....Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm² (4 AWG) and larger shall be permitted to be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

C. Isolated Power System: Type XHHW-2 insulation with a dielectric constant of 3.5 or less.

D. Electrical System Grounding: Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

2.2 SPLICES AND TERMINATION COMPONENTS

Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.3 GROUND CONNECTIONS

A. Above Grade:
   1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.
   2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
   3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.

2.4 EQUIPMENT RACK AND CABINET GROUND BARS

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x ¾ inch).

2.5 GROUND TERMINAL BLOCKS

At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.6 SPLICE CASE GROUND ACCESSORIES

Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm^2 (6 AWG) insulated ground wire with shield bonding connectors.

PART 3 - EXECUTION

3.1 GENERAL

A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.
B. System Grounding:
   1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
   2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
   3. Isolation transformers and isolated power systems shall not be system grounded.
C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes,

cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections, that are normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS

A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.

B. Metallic Conduit: Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

3.4 SECONDARY EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
2. Provide a supplemental ground electrode and bond to the grounding electrode system.

C. Switchboards:

1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
2. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

D. Transformers:

1. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest

component of the grounding electrode system or the ground bar at the service equipment.

E. Conduit Systems:
   1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
   2. Non-metallic conduit systems shall contain an equipment grounding conductor.
   3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

F. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.

G. Boxes, Cabinets, Enclosures, and Panelboards:
   1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
   2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
   3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

H. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

I. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

J. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

K. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

L. Panelboard Bonding: The equipment grounding terminal buses of the normal and essential branch circuit panelboards serving the same individual patient vicinity shall be bonded together with an insulated

continuous copper conductor not less than 16 mm² (10 AWG). These conductors shall be installed in rigid metal conduit.

3.5 CORROSION INHIBITORS

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.6 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

B. In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping, at the outlets, directly to the room or patient ground bus.

3.7 ELECTRICAL ROOM GROUNDING

Building Earth Ground Busbars: Provide ground busbar hardware at each electrical room and connect to pigtail extensions of the building grounding ring.

3.8 WIREWAY GROUNDING

A. Ground and Bond Metallic Wireway Systems as follows:

1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm² (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated 16 mm² (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 16 meters (50 feet).
3. Use insulated 16 mm² (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.
4. Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

3.9 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system

for compliance without additional cost to the Government. Final tests shall assure that this requirement is met.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

3.10 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.

B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.

C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

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SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Sealing around penetrations to maintain the integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.

B. Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 07 92 00, JOINT SEALANTS.

C. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

D. General electrical requirements and items that is common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

E. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.3 SUBMITTALS

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

A. Shop Drawings:

1. Size and location of main feeders;
2. Size and location of panels and pull boxes
3. Layout of required conduit penetrations through structural elements.
4. The specific item proposed and its area of application shall be identified on the catalog cuts.

B. Certification: Prior to final inspection, deliver to the Contracting Officer Technical Representative (COTR) four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. National Fire Protection Association (NFPA):
70-05.....National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL):
1-03.....Flexible Metal Conduit
5-01.....Surface Metal Raceway and Fittings
6-03.....Rigid Metal Conduit
50-03.....Enclosures for Electrical Equipment
360-03.....Liquid-Tight Flexible Steel Conduit
467-01.....Grounding and Bonding Equipment
514A-01.....Metallic Outlet Boxes
514B-02.....Fittings for Cable and Conduit
514C-05.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-02.....Schedule 40 and 80 Rigid PVC Conduit
651A-03.....Type EB and A Rigid PVC Conduit and HDPE Conduit
797-03.....Electrical Metallic Tubing
1242-00.....Intermediate Metal Conduit

D. National Electrical Manufacturers Association (NEMA):
TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and Tubing
FB1-03.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 19 mm (3/4 inch) unless otherwise shown. Where permitted by the NEC, 19 mm (3/4 inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:
1. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
2. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.
3. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.

4. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.
5. Flexible galvanized steel conduit: Shall Conform to UL 1.
6. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
7. Surface metal raceway: Shall Conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
   a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
   a. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
   e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Rigid aluminum conduit fittings:
   a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
   b. Locknuts and bushings: As specified for rigid steel and IMC conduit.
   c. Set screw fittings: Not permitted for use with aluminum conduit.
3. Electrical metallic tubing fittings:

a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
b. Only steel or malleable iron materials are acceptable.
c. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
d. Indent type connectors or couplings are prohibited.
e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

4. Flexible steel conduit fittings:
   a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   b. Clamp type, with insulated throat.
5. Liquid-tight flexible metal conduit fittings:
   a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
6. Direct burial plastic conduit fittings:
   a. Fittings shall meet the requirements of UL 514C and NEMA TC3.
   b. As recommended by the conduit manufacturer.
7. Surface metal raceway fittings: As recommended by the raceway manufacturer.
8. Expansion and deflection couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
   c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
   d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:
   1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
   2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
   3. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
   4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:
   1. UL-50 and UL-514A.
   2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
   3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
   4. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:
   1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COTR prior to drilling through structural sections.
   2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COTR as required by limited working space.

B. Fire Stop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

A. In accordance with UL, NEC, as shown, and as hereinafter specified.

B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where specifically "accepted" by NEC Article 517.

C. Install conduit as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically and electrically continuous.
6. Independently support conduit at 8’0” on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Do not use aluminum conduits in wet locations.
12. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

D. Conduit Bends:

1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
   1. Install conduit with wiring, including homeruns, as shown.
   2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COTR.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
   1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
   2. Align and run conduit in direct lines.
   3. Install conduit through concrete beams only when the following occurs:
      a. Where shown on the structural drawings.
      b. As approved by the COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
   4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
      a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
      b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
      c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
   5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:
   1. Conduit for conductors above 600 volts:
      a. Rigid steel or rigid aluminum.
      b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
   2. Conduit for conductors 600 volts and below:
      a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
   3. Align and run conduit parallel or perpendicular to the building lines.

4. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (six feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
B. Conduit for conductors above 600 volts:
   1. Rigid steel or rigid aluminum.
   2. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
C. Conduit for Conductors 600 volts and below:
   1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
D. Align and run conduit parallel or perpendicular to the building lines.
E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
F. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.
G. Surface metal raceways: Use only where shown.
H. Painting:
   1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
   2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.
B. Install UL approved sealing fittings, that prevent passage of explosive vapors, in hazardous areas equipped with explosive proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.6 WET OR DAMP LOCATIONS

A. Unless otherwise shown, use conduits of rigid steel or IMC.
B. Provide sealing fittings, to prevent passage of water vapor, where conduits pass from warm to cold locations, i.e., (refrigerated spaces,

constant temperature rooms, air conditioned spaces building exterior walls, roofs) or similar spaces.

C. Unless otherwise shown, use rigid steel or IMC conduit within 1500 mm (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall include an outer factory coating of .5 mm (20 mil) bonded PVC or field coat with asphaltum before installation. After installation, completely coat damaged areas of coating.

3.7 MOTORS AND VIBRATING EQUIPMENT

A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.

B. Provide liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside (air stream) of HVAC units, and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with flexible metal conduit.

3.8 EXPANSION JOINTS

A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.

C. Install expansion and deflection couplings where shown.

3.9 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
2. Existing Construction:
   a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
   b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
   c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts are permitted.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.10 BOX INSTALLATION

A. Boxes for Concealed Conduits:

1. Flush mounted.
2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes.)

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.

F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

G. On all Branch Circuit junction box covers, identify the circuits with black marker.

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SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of panelboards.

1.2 RELATED WORK

A. Section 09 91 00, PAINTING: Identification and painting of panelboards.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.

C. Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY: Requirements for the over current protective devices to be installed to ensure proper equipment and personnel protection.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlet boxes.

E. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting details, materials, wiring diagrams accessories and weights of equipment. Complete nameplate data including manufacturer’s name and catalog number.

C. Certification: Two weeks prior to final inspection, submit four copies of the following to the Contracting Officer Technical Representative (COTR):

1. Certification that the material is in accordance with the drawings and specifications has been properly installed, and that the loads are balanced.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

A. National Electrical Manufacturers Association (NEMA):
PB-1-2006.....Panelboards
AB-1-2002.....Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures

B. National Fire Protection Association (NFPA):
70-2005 .....National Electrical Code (NEC)
70E-2004.....Standard for Electrical Life Safety in the Workplace

C. Underwriters Laboratories, Inc. (UL):
50-2003.....Enclosures for Electrical Equipment
67-2003.....Panel boards
489-2006.....Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings.

B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.

C. All panelboards shall be hinged “door in door” type with:
   1. Interior hinged door with hand operated latch or latches as required to provide access to circuit breaker operating handles only, not to energized ports.
   2. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips or other fasteners requiring a tool for entry, hand operated latches are not acceptable.
   3. Push inner and outer doors shall open left to right.

D. All panelboards shall be completely factory assembled with molded case circuit breakers. Include one-piece removable, inner dead front cover independent of the panelboard cover.

E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings.

F. Panelboards shall conform to NEMA PB-1, NEMA AB-1 and UL 67 and have the following features:

1. Nonreduced size copper or aluminum bus bars, complete with current ratings as shown on the panel schedules connection straps bolted together and rigidly supported on molded insulators.
2. Bus bar connections to the branch circuit breakers shall be the “distributed phase” or “phase sequence” type. Single-phase, three-wire panelboard busing shall be such that when any two adjacent single-pole breakers are connected to opposite phases, two-pole breakers can be installed in any location. Three-phase, four-wire busing shall be such that when any three adjacent single-pole breakers are individually connected to each of the three different phases, two-or three-pole breakers can be installed at any location. Current-carrying parts of the bus assembly shall be plated. Mains ratings shall be as shown.
3. Mechanical lugs furnished with panelboards shall be cast, stamped or machined metal alloys of sizes suitable for the conductors indicated to be connected thereto.
4. Neutral bus shall be 100% rated, mounted on insulated supports.
5. Grounding bus bar equipped with screws or lugs for the connection of grounding wires.
6. Buses braced for the available short circuit current, but not less than 22,000 amperes symmetrical for 120/208 volt and 120/240 volt panelboards, and 14,000 amperes symmetrical for 277/480-volt panelboards.
7. Branch circuit panels shall have buses fabricated for bolt-on type circuit breakers.
8. Protective devices shall be designed so that they can be easily replaced.
9. Where designated on panel schedule "spaces", include all necessary bussing, device support and connections. Provide blank cover for each space.
10. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs

on the line side of main lugs only, or through-feed lugs for main breaker type panels, and with cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.

11. Series rated panelboards are not permitted.

2.2 CABINETS AND TRIMS

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL 50 and UL 67.
2. Cabinet enclosure shall not have ventilating openings.
3. Cabinets for panelboards may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

A. Breakers shall be UL 489 listed and labeled, in accordance with the NEC, as shown on the drawings, and as specified.

B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.

1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated but not less than:
   a. 120/208 Volt Panelboard: 22,000 amperes symmetrical.
   b. 120/240 Volt Panelboard: 22,000 amperes symmetrical.
   c. 277/480 Volt Panelboard: 14,000 amperes symmetrical.
2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100-ampere frame or less. Magnetic trip shall be adjustable from 3X to 10X for breakers with 600 ampere frames and higher. Breaker trip setting shall be set in the field based on the approved protective device study as specified in Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY. Factory setting shall be HI, unless otherwise noted.

C. Breaker features shall be as follows:

1. A rugged, integral housing of molded insulating material.
2. Silver alloy contacts.
3. Arc quenchers and phase barriers for each pole.

4. Quick-make, quick-break, operating mechanisms.
5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
6. Electrically and mechanically trip free.
7. An operating handle which indicates ON, TRIPPED, and OFF positions.
   a. Line connections shall be bolted.
   b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings, as shown on the electrical system protective device study as required in Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY.
8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.
9. Shunt trips shall be provided where indicated
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory to “as built” conditions.

2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the Manufacturer’s instructions, the NEC, as shown on the drawings, and as specified.
B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated closet space.
C. In accordance with Section 09 91 00, PAINTING, paint the panelboard system voltage, and feeder sizes as shown on the riser diagram in 1 inch block lettering on the inside cover of the cabinet door. Paint the words "LIFE SAFETY BRANCH", "CRITICAL BRANCH", or "EQUIPMENT SYSTEM" as

applicable and the panel designation in one inch block letters on the outside of the cabinet doors.

D. Install a typewritten schedule of circuits in each panelboard after being submitted to and approved by the COTR. Schedules, after approval, shall be typed on the panel directory cards and installed in the appropriate panelboards, incorporating all applicable contract changes pertaining to that schedule. Include the room numbers and items served on the cards.

E. Mount the panelboard fully aligned and such that the maximum height of the top circuit breaker above finished floor shall not exceed 1980 mm (78 inches). For panelboards that are too high, mount panelboard so that the bottom of the cabinets will not be less than 150 mm (6 inches) above the finished floor.

F. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.

G. Directory-card information shall be typewritten to indicate outlets, lights, devices, and equipment controlled and final room numbers served by each circuit and shall be mounted in holders behind protective covering.

H. Where new panels are to be installed in existing backboxes, backboxes shall have rust and scale removed from inside. Paint inside of backboxes with rust preventive paint before the new panel interior is installed. Provide new trim and doors for these panels. Covers shall fit tight to the box with no gaps between the cover and the box.

I. Provide ARC flash identification per NFPA 70E.

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SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of wiring devices.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.

B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlets boxes.

C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

1.3 SUBMITTALS

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting details, construction materials, grade and termination information.

C. Manuals: Two weeks prior to final inspection, deliver four copies of the following to the Contracting Officer Technical Representative (COTR): Technical data sheets and information for ordering replacement units.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR: Certification by the Contractor that the devices comply with the drawings and specifications, and have been properly installed, aligned, and tested.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. National Fire Protection Association (NFPA):

70-02.....National Electrical Code (NEC)

C. National Electrical Manufacturers Association (NEMA):
WD 1-99.....General Color Requirements for Wiring Devices
WD 6-02 .....Wiring Devices – Dimensional Requirements

D. Underwriter's Laboratories, Inc. (UL):
5-96.....Surface Metal Raceways and Fittings
20-00.....General-Use Snap Switches
231-98.....Power Outlets
467-93.....Grounding and Bonding Equipment
498-01.....Attachment Plugs and Receptacles
943-03.....Ground-Fault Circuit-Interrupters

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall be listed by Underwriters Laboratories, Inc., as hospital grade (green dot identification) and conform to NEMA WD 1. (EXCEPTION - Receptacle types which have no listing as hospital grade but are listed by UL in their respective categories or receptacles indicated on the drawings as "not hospital grade").
   1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
   2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four min.) and side wiring from four captively held binding screws.

B. Duplex receptacles shall be single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.
   1. Bodies shall be ivory in color.
   2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.
   3. Duplex Receptacles on Emergency Circuit:
      a. Bodies shall be red in color. Wall plates shall be red with the word "EMERGENCY" engraved in 6 mm, (1/4 inch) white letters.
      b. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.
   4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.

a. Ground fault interrupter shall be hospital grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. Device shall have nominal sensitivity to ground leakage current of five milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or – 1 milliamp) on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.

5. Safety Type Duplex Receptacles:
   a. Bodies shall be gray in color.
   b. Shall be hospital grade, as above with the following additional requirements.
      1) Shall permit current to flow only while a standard plug is in the proper position in the receptacle.
      2) Screws exposed while the wall plates are in place shall be the tamperproof type.
   c. Shall be installed in the following locations:
      1) Housekeeping quarters, buildings, waiting areas and lobbies where children might be present.
6. Isolated Ground Type Duplex Receptacles:
   a. Bodies shall be orange in color.
   b. Shall be hospital grade and UL listed as “Isolated Ground”.
7. Duplex Receptacles (not hospital grade): Shall be the same as hospital grade duplex receptacles except for the "hospital grade" listing and as follows.
   a. Bodies shall be brown phenolic compound supported by a plated steel mounting strap having plaster ears.
   b. Shall be NEMA WD 1 heavy duty type.

C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete with appropriate cord grip plug. Devices shall meet UL 231.

D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

E. Lamp Receptacles for Outlet Box Mounting:
   1. For use on standard 75 mm (3 inch) and 100 mm (4 inch) outlet boxes.
   2. Keyless, porcelain body and skirt supporting a medium screw shell socket, and integral 3-wire grounding receptacle shall have screw terminals and a minimum rating of 600 watts.
   3. Porcelain neck shall have shade holder groove.

2.2 TOGGLE SWITCHES AND DIMMERS

A. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles shall be ivory in color unless otherwise specified. The rocker type switch is not acceptable and will not be approved.
   1. Switches installed in hazardous areas shall be explosion proof type in accordance with the NEC and as shown on the drawings.
   2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
   3. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
   4. Ratings:
      a. 120 volt circuits: 20 amperes at 120-277 volts AC.
      b. 277 volt circuits: 20 amperes at 120-277 volts AC.
   5. The switches shall be mounted on the striker plate side of doors.
   6. Incorporate barriers between switches with multigang outlet boxes where required by the NEC.
   7. Switches connected to isolated type electrical power systems shall be double pole.
   8. All toggle switches shall be of the same manufacturer.

2.3 WALL PLATES

A. Wall plates for switches and receptacles shall be smooth nylon to match Hospital Standard. Oversize plates are not acceptable.
B. Color shall be ivory unless otherwise specified.
C. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.
D. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

E. In psychiatric areas, wall plates shall have tamperproof screws and beveled edges.

F. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.

2.4 SURFACE MULTIPLE-OUTLET ASSEMBLIES

A. Assemblies shall conform to the requirements of NFPA 70 and UL 5.

B. Shall have the following features:

1. Enclosures:

   a. Thickness of steel shall be not less than 1 mm (0.040 inch) steel for base and cover. Nominal dimension shall be 40 by 70 mm (1-1/2 by 2-3/4 inches) with inside cross sectional area not less than 2250 square mm (3.5 square inches). The enclosures shall be thoroughly cleaned, phosphatized and painted at the factory with primer and the manufacturer's standard baked enamel or lacquer finish.

2. Receptacles shall be duplex, hospital grade. See paragraph 'RECEPTACLES' in this section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.

3. Unless otherwise shown on drawings, spacing of the receptacles along the strip shall be 600 mm (24 inches) on centers.

4. Wires within the assemblies shall be not less than No. 12 AWG copper, with 600 volt ratings.

5. Installation fittings shall be designed for the strips being installed including bends, offsets, device brackets, inside couplings, wire clips, and elbows.

6. Bond the strips to the conduit systems for their branch supply circuits.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC and as shown as on the drawings.

B. All receptacles shall be installed with ground pin socket at the top of the receptacle.

C. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the green equipment grounding conductor.

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SECTION 26 29 11
LOW-VOLTAGE MOTOR STARTERS

PART 1 - GENERAL

1.1 DESCRIPTION

All motor starters and motor control stations including installation and connection (whether furnished with the equipment specified in other Divisions or otherwise) shall meet these specifications.

1.2 RELATED WORK

A. Other sections which specify motor driven equipment, except elevator motor controllers.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:

A. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, weights, mounting details, materials, running over current protection, size of enclosure, over current protection, wiring diagrams, starting characteristics, interlocking and accessories.

B. Manuals:

1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams and information for ordering replacement parts.
   a. Wiring diagrams shall have their terminals identified to facilitate installation, maintenance and operation.
   b. Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
   c. Elementary schematic diagrams shall be provided for clarity of operation.
2. Two weeks prior to the project final inspection, submit four copies of the final updated maintenance and operating manual to the

Contracting Officer Technical Representative (COTR). (Update manual to include any information necessitated by shop drawing approval).

C. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certifications to the COTR:
   1. Certification by the manufacturer that the controllers have passed the factory 24-hour operational test. (This certification must be furnished to the COTR prior to shipping the controller to the job site.)
   2. Certification by the manufacturer that high voltage motor controller(s) conforms to the requirements of the drawings and specifications. (This certification must be furnished to the COTR prior to shipping the controller to the job site.).
   3. Certification that the equipment has been properly installed, adjusted, and tested.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. Institute of Electrical and Electronic Engineers (IEEE):
   519-92.....Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
   C37.90.1-02.....Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems

C. National Electrical Manufacturers Association (NEMA):
   ICS 1-00.....Industrial Control and Systems General Requirements
   ICS 1.1-03.....Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
   ICS 2-00.....Industrial Control and Systems, Controllers, Contactors and Overload Relays Rated 600 Volts DC
   ICS 6-01.....Industrial Control and Systems Enclosures
   ICS 7-00.....Industrial Control and Systems Adjustable-Speed Drives
   ICS 7.1-00.....Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems

D. National Fire Protection Association (NFPA):
70-02.....National Electrical Code (NEC)

E. Underwriters Laboratories Inc. (UL):
508-99.....Industrial Control Equipment

PART 2 - PRODUCTS

2.1 MOTOR STARTERS, GENERAL

A. Motor starters shall be in accordance with the requirements of the IEEE, NEC, NEMA (ICS 1, ICS 1.1, ICS 2, ICS 6, ICS 7 and ICS 7.1) and UL.

B. Shall have the following features:
   1. Separately enclosed unless part of another assembly.
   2. Circuit breakers and safety switches within the motor controller enclosures shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.
   3. Motor control circuits:
      a. Shall operate at not more than 120 volts.
      b. Shall be grounded except as follows:
         1) Where isolated control circuits are shown.
         2) Where manufacturers of equipment assemblies recommend that the control circuits be isolated.
      c. Incorporate a separate, heavy duty, control transformer within each motor controller enclosure to provide the control voltage for each motor operating over 120 volts.
      d. Incorporate over current protection for both primary and secondary windings of the control power transformers in accordance with the NEC.
   4. Overload current protective devices:
      a. Overload relay (thermal or induction type.
      b. One for each pole.
      c. Manual reset on the door of each motor controller enclosure.
      d. Correctly sized for the associated motor's rated full load current.
      e. Check every motor controller after installation and verify that correct sizes of protective devices have been installed.
      f. Deliver four copies of a summarized list to the Resident Engineer, which indicates and adequately identifies every motor controller installed. Include the catalog numbers for the correct sizes of protective devices for the motor controllers.

5. Hand-Off-Automatic (H-O-A) switch is required unless specifically stated on the drawings as not required for a particular starter. H-O-A switch is not required for manual motor starters.
6. Incorporate into each control circuit a 120-volt, solid state time delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time delay relay is not required where H-O-A switch is not required.
7. Auxiliary contacts, pilot lights, pushbuttons and other devices and accessories as shown on the drawings or otherwise required.
8. Enclosures:
   a. Shall be the NEMA types shown on the drawings for the motor controllers.
   b. Shall be the NEMA types which are the most suitable for the environmental conditions where the motor controllers are being installed.
   c. Doors mechanically interlocked to prevent opening unless the breaker or switch within the enclosure is open. Provision for padlock must be provided.
   d. Enclosures shall be primed and finish coated at the factory with the manufacturer’s prime coat and standard finish.

C. Motor controllers incorporated with equipment assemblies shall also be designed for the specific requirements of the assemblies.

D. For motor controllers being installed in existing motor control centers or panelboards, coordinate with the existing centers or panelboards.

E. Additional requirements for specific motor controllers, as indicated in other sections, shall also apply.

F. Provide a disconnecting means or safety switch near and within sight of each motor. Provide all wiring and conduit required to facilitate a complete and code complied installation.

G. Refer to paragraph, MOTOR CONTROL STATIONS, in this section for additional requirements.

2.2 MANUAL MOTOR STARTERS

A. Shall be in accordance with applicable requirements of 2.1 above.

B. Manual motor starters.
   1. Starters shall be AC, general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.
   2. Units shall include overload and low voltage protection, red pilot light, NO, NC auxiliary contact and toggle operator.

C. Fractional horsepower manual motor starters.
   1. Starters shall be AC, general-purpose Class A, manually operated with full voltage controller for fractional horsepower induction motors.
   2. Units shall include thermal overload protection, red pilot light and toggle operator.
D. Motor starting switches.
   1. Switches shall be AC, general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.
   2. Units shall include thermal overload protection, red pilot light, low voltage protection, NO, NC auxiliary contact and toggle operator.

2.3 MAGNETIC MOTOR STARTERS

A. Shall be in accordance with applicable requirements of 2.1 above.
B. Starters shall be AC, general-purpose, Class A magnetic controllers for induction motors rated in horsepower. Minimum size 0.
C. Where combination motor starters are used, combine starter with protective or disconnect device in a common enclosure.
D. Provide phase loss protection for each starter, with contacts to de-energize the starter upon loss of any phase.

2.4 REDUCED VOLTAGE MOTOR CONTROLLERS

A. Shall be in accordance with applicable portions of 2.1 above.
B. Shall be installed where shown for motors on the contract drawings.
C. Shall have closed circuit transition for the types which can incorporate such transition.
D. Shall limit inrush currents to not more than 70 percent of the locked rotor currents.
E. Provide phase loss protection for each starter, with contacts to de-energize the starter upon loss of any phase.

2.5 HIGH VOLTAGE MOTOR CONTROLLERS

A. Shall be in accordance with applicable portions of 2.1 above.
B. Shall have the following additional features:
   1. Metal enclosed, free-standing, air break, reduced voltage, primary reactor, drawout type combined with fused disconnect switch.
   2. Shall include the following components:
      a. Three pole, air break, drawout type, start contactor.
      b. Three pole, air break, drawout type, run contactor. Primary reactor with taps for 50, 65 and 80 percent of line voltage.
      d. Definite time transfer relay.
      e. Three current limiting, power type fuses.

f. Control power transformer, protected with current limiting fuses.
g. Three current transformers and over current protective devices.
h. Zero-sequence current transformers and associated devices for ground fault protection.
i. Under voltage protection.
j. Protection against single phasing.
k. Stator thermal protection.
l. Indicating type ammeter and selector switch.
m. Red and green indicating lights.

3. A separate enclosure for each motor controller.
4. Shall be isolated by an externally operated mechanism. The secondary of the control power transformer shall also be opened by that device.
5. Suitable and adequate compartments and barriers for high voltage components. Isolate the power bus from the normally accessible compartments.
6. High voltage line receptacles shall be shuttered automatically when conductors are in the disconnected position and the disconnection shall be clearly indicated.
7. Interlocks shall include prevention of the following:
   a. Inadvertent operation of the isolating mechanism under load.
   b. Opening of the high voltage compartment before the controller is isolated.
   c. Closing of the line contactor while the door is open.
8. Current and potential transformers for operating remote recording watt-hour and demand meters and the indicating meters at the motor controller.
9. Lock-open padlocking provisions.
10. Furnish accessories as recommended by the manufacturer of the motor controllers to facilitate convenient operation and maintenance of the controllers.

C. Interrupting ratings shall be not less than the maximum short circuit currents available where the controllers are being installed or as indicated on the drawings.

2.6 VARIABLE SPEED MOTOR CONTROLLERS

A. Shall be in accordance with applicable portions of 2.1 above.
B. Shall be solid state, micro processor-based with adjustable frequency and voltage, three phase output capable of driving standard NEMA B design, three phase alternating current induction motors at full rated speed. The drives shall utilize a full wave bridge design incorporating

diode rectifier circuitry with pulse width modulation (PWM). Other control techniques are not acceptable. Silicon controlled rectifiers (SCR) shall not be used in the rectifying circuitry. The drives shall be designed to be used on variable torque loads and shall be capable of providing sufficient torque to allow the motor to break away from rest upon first application of power.

C. Shall be rated for input power of 208 or 480 volts, three phase, 60 Hz as shown on Contract Drawings. Unit shall be capable of operating within voltage parameters of plus 10 to minus 10 percent of line voltage, and be suitably rated for the full load amps of the maximum watts (HP) within its class.

D. Each controller shall be factory tested at maximum watts (HP), rated full load current and at an ambient temperature of 40 degrees C for a period of not less than 24 hours. If a component fails, it shall be replaced and the test restarted for the full time period. A certified copy of the factory Test Report shall be furnished to the COTR prior to shipping the controller to the job site.

E. Controllers shall have the following features:
   1. Isolated power for control circuits.
   2. Manually re-settable motor overload protection for each phase.
   3. Adjustable current limiting circuitry to provide soft motor starting. Maximum starting current shall not exceed 200 percent of motor full load current.
   4. Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 30 seconds. (Set timers to the equipment manufacturer's recommended time in the above range.)
   5. Provide 4 to 20 ma current follower circuitry for interface with mechanical sensor devices.
   6. Automatic frequency adjustment from 20 Hz to 60 Hz.
   7. Provide circuitry to initiate an orderly shutdown when any of the conditions listed below occur. The controller shall not be damaged by any of these electrical disturbances and shall automatically restart when the conditions are corrected:
      a. Incorrect phase sequence.
      b. Single phasing.
      c. Over voltage in excess of 10 percent.
      d. Under voltage in excess of 10 percent.
      e. Running over current above 110 percent (shall not automatically reset for this condition.)

f. Instantaneous overcurrent above 150 percent (shall not automatically reset for this condition).
g. Surge voltage in excess of 1000 volts.
h. Short duration power outages of 12 cycles or less (i.e., distribution line switching, generator testing, and automatic transfer switch operations.)

F. Minimum efficiency shall be 95 percent at 100 percent speed and 85percent at 50 percent speed.
G. The displacement power factor of the controller shall not be less than 95 percent under any speed or load condition.
H. Controllers shall include a door interlocked fused safety disconnect switch or door interlocked circuit breaker switch which will disconnect all input power.
I. Include a by-pass starter with circuitry to protect and isolate the variable speed controller. When the variable speed controller is in the by-pass mode, the solid-state components shall be isolated from the power supply on both the line and motor side.
J. The following accessories are to be door mounted:
1. AC Power on light.
2. Ammeter (RMS motor current).
3. HAND-OFF-AUTOMATIC switch.
4. Manual speed control in HAND mode.
5. System protection lights indicating that the system has shutdown and will not automatically restart.
6. System protection light indicating that the system has shutdown but will restart when conditions return to normal.
7. Manual variable speed controller by-pass switch.
8. Diagnostic shutdown indicator lights for each shutdown condition.
9. Provide two N.O. and two N.C. dry contacts rated 120 volts, 10 amperes, 60 HZ for remote indication of the following:
a. System shutdown with auto restart.
b. System shutdown without auto restart.
C. System running.
10. Incorporate into each control circuit a 120-volt, time delay relay (ON delay), adjustable from 0.3-10 minutes, with transient protection. Provide transformer/s for the control circuit/s.
11. Controller shall not add any current or voltage transients to the input AC power distribution system nor shall transients from other devices on the AC power distribution system affect the controller.

Controllers shall be protected to comply with IEEE C37.90.1 and UL-508. Line noise and harmonic voltage distortion shall not exceed the values allowed by IEEE 519. Include Harmonic filter within the enclosure of the VFD.

2.7 MOTOR CONTROL STATIONS

A. Shall have the following features:
   1. Designed for suitably fulfilling the specific control functions for which each station is being installed.
   2. Coordinate the use of momentary contacts and maintained contacts with the complete motor control systems to insure safety for people and equipment.
   3. Each station shall have two pilot lights behind red and green jewels and a circuit to its motor controller. Connect the lamps so they will be energized as follows:
      a. Red while the motor is running.
      b. Green while the motor is stopped.
   4. Where two or more stations are mounted adjacent to each other, install a common wall plate, except where the designs of the stations make such common plates impracticable.
   5. Identify each station with a permanently attached individual nameplate, of laminated black phenolic resin with a white core and engraved lettering not less than 6 mm (1/4-inch) high. Identify the motor by its number or other designation and indicate the function fulfilled by the motor.

B. Components of Motor Control Circuits:
   1. Shall also be designed and arranged so that accidental faulting or grounding of the control conductors will not be able to start the motors.
   2. Use of locking type STOP pushbuttons or switches, which cause motors to restart automatically when the pushbuttons or switches are released, will not be permitted.

2.8 PROVIDE INTERNALLY INTEGRATED SURGE PROTECTIVE DEVICES FOR EACH CONTROLLER:

A. Integral Surge Suppressor:
   1. SPD (Surge Protective Devices) shall be Component Recognized and listed in accordance with UL 1449 Second Edition to include Section 37.3 highest fault category testing on devices intended for service entrance use. SPD shall also be UL 1283 listed.
   2. SPD shall be UL 67 listed, installed by and shipped from the electrical distribution equipment manufacturer’s factory.

3. SPD shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G, in WYE systems, and L-L, L-G in DELTA systems.
4. SPD shall be modular in design. Each mode shall be fused with a 200kAIC; UL recognized surge rated fuse and incorporate a thermal cutout device.
5. SPD shall be integrally mounted to the bus bars of the switchboard.
6. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided as well.
7. SPD shall meet or exceed the following criteria:
   a. Maximum surge current capability (single pulse rated) per phase shall be:
      1) Service Entrance Switchboard 250 kA.
      2) Distribution Panelboards 160 kA
      3) Branch Panelboards 160 kA
      4) Service Entrance MCC 240 kA specified.
      5) Distribution Class MCC 160 kA
   b. UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings (SVR’s) for Service Entrance and Distribution Location equipment shall not exceed the following:
   c. Voltage Let-Thru values for Solidly Grounded Systems:

VOLTAGE	L-N	L-G	N-G
208Y/120	400V	400V	400V
480Y/277	800V	800V	800V

8. SPD shall have a minimum EMI/RFI filtering of –50Db at 100 kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology.
9. SPD shall have the following diagnostic features: transient counter, status lights on each phase, and one set of 1 NO and 1 NC auxiliary dry contacts for alarming.
10. SPD shall have a warranty for a period of five years, incorporating unlimited replacements of suppressor parts if transients destroy them during the warranty period. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field service division.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor control equipment in accordance with manufacturer's recommendations, the NEC, NEMA and as shown on the drawings.

B. Install Variable Speed Motor Controllers in accordance with manufacturers recommendations, the NEC, as shown on the drawings and in accordance with NEMA ICS 7.1.C.

C. Furnish and install heater elements in motor starters to match the installed motor characteristics.

3.2 SPARE PARTS

Two weeks prior to the final inspection, provide one complete set of spare fuses (including heater elements) for each starter/controller installed on this project to the COTR.

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SECTION 26 29 21
DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of low voltage disconnect switches.

1.2 RELATED WORK

A. General electrical requirements and items that is common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Conduits for cables and wiring: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

C. Cables and wiring: Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW.

D. Motor rated toggle switches: Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

E. Requirements for personnel safety and to provide a low impedance path for possible ground faults: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Shop Drawings:

1. Include sufficient information, clearly presented to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting details, materials, enclosure types, fuse type and class.
3. Show the specific switch and fuse proposed for each specific piece of equipment or circuit.

C. Manuals:

1. Provide complete maintenance and operating manuals for disconnect switches, including technical data sheets, wiring diagrams, and information for ordering replacement parts. Deliver four copies to the Contracting Officer Technical Representative (COTR)two weeks prior to final inspection.
2. Identify terminals on wiring diagrams to facilitate maintenance and operation.
3. Wiring diagrams shall indicate internal wiring and any interlocking.

D. Certification: Two weeks prior to final inspection, deliver to the COTR four copies of the certification that the equipment has been properly installed, adjusted, and tested.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. National Electrical Manufacturers Association (NEMA):
KS l-01.....Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

C. National Fire Protection Association (NFPA):
70-05.....National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):
98-98.....Enclosed and Dead-Front Switches
198C-89.....High-Interrupting-Capacity Fuses, Current Limiting Types
198E-94.....Class R Fuses
977-99.....Fused Power-Circuit Devices

PART 2 - PRODUCTS

2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 600 AMPERES AND LESS

A. Shall be quick-make, quick-break type in accordance with UL 98, NEMA KS 1 and NEC.

B. Shall have a NEMA classification Heavy Duty (HD).

C. Shall be horsepower rated.

D. Shall have the following features:

1. Switch mechanism shall be the quick-make, quick-break type.
2. Copper blades, visible in the OFF position.
3. An arc chute for each pole.
4. External operating handle shall indicate ON and OFF position and shall have lock-open padlocking provisions.
5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable by a special tool to permit inspection.
6. Fuse holders for the sizes and types of fuses specified.
7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
8. Ground Lugs: One for each ground conductor.
9. Enclosures:

a. Shall be the NEMA types shown on the drawings for the switches.
b. Where the types of switch enclosures are not shown, they shall be the NEMA types which are most suitable for the environmental conditions where the switches are being installed. Unless otherwise indicated on the plans, all outdoor switches shall be NEMA 3R.
c. Shall be finished with manufacturer’s standard gray baked enamel paint over pretreated steel (for the type of enclosure required).

2.2 LOW VOLTAGE UNFUSED SWITCHES RATED 600 AMPERES AND LESS

Unfused switches are not acceptable, all switches shall be fusible type.

2.3 LOW VOLTAGE FUSIBLE SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERES

Shall be the same as Low Voltage Fusible Switches Rated 600 Amperes and Less, except for the minimum duty rating which shall be NEMA classification Heavy Duty (HD). These switches shall also be horsepower rated.

2.4 MOTOR RATED TOGGLE SWITCHES

Refer to Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS for motor rated toggle switches.

2.5 IDENTIFICATION SIGNS

A. Install nameplate identification signs on each disconnect switch to identify the equipment controlled.
B. Nameplates shall be laminated black phenolic resin with a white core, with engraved lettering, a minimum of 6 mm (1/4-inch) high. Secure nameplates with screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches in accordance with the NEC and as shown on the drawings.
B. Fusible disconnect switches shall be furnished complete with fuses.

3.2 SPARE PARTS

Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fusible disconnect switch installed on the project. Deliver the spare fuses to the COTR.

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SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of the interior lighting systems.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.

B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

C. Section 26 27 26, WIRING DEVICES: Wiring devices used as part of the lighting systems.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Refer to Paragraph, GUARANTY, in Section 00 72 00, GENERAL CONDITIONS.

1.4 SUBMITTALS

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, lenses, louvers, lamps, and controls.
3. When catalog data and/or shop drawings for fluorescent fixtures are submitted for approval, photometric data from an independent testing laboratory shall be included with the submittal, indicating average brightness and efficiency of the fixture, as specified in specification or as shown on the drawings. Coefficient of utilization data will not be considered a suitable substitute.

C. Manuals:

1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.

2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the Contracting Officer Technical Representative (COTR).

D. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following certifications to the COTR:
   a. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.
   b. Include with shop drawings, certification from the manufacturers that all electronic high-frequency ballasts meet the transient protection required by IEEE C62.41, Cat. A. Include with initial shop drawing submittal.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American National Standards Institute (ANSI):

C78.1-91.....Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics

C78.2-91.....Fluorescent Lamps - Preheat-Start Types - Dimensional and Electrical Characteristics

C78.3-91.....Fluorescent Lamps - Instart Start and Cold-Cathode Types - Dimensional and Electrical Characteristics

C78.376-91.....Chromaticity of Fluorescent Lamps (ANSI/NEMA C78/376-96)

C. Certified Ballast Manufacturers Association (CBM):

Requirements for Ballast Certification.

D. Institute of Electrical and Electronic Engineers (IEEE):

C62.41-91.....Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits

E. National Fire Protection Association (NFPA):

70-02.....National Electrical Code (NEC)

101-00.....Life Safety Code

F. National Electrical Manufacturer's Association (NEMA)

C82.1-97.....Ballasts for Fluorescent Lamps - Specifications

C82.2-02.....Method of Measurement of Fluorescent Lamp Ballasts

C82.4-02.....Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps

C82.11-02.....High Frequency Fluorescent Lamp Ballasts

G. Underwriters Laboratories, Inc. (UL):

496-96.....Edison-Base Lampholders

542-99.....Lampholders, Starters, and Starter Holders for Fluorescent Lamps

844-95.....Electric Lighting Fixtures for Use in Hazardous (Classified) Locations

924-95.....Emergency Lighting and Power Equipment

935-01.....Fluorescent-Lamp Ballasts

1029-94.....High-Intensity-Discharge Lamp Ballasts

1598-00.....Luminaires

H. Federal Communications Commission (FCC):

Code of Federal Regulations (CFR), Title 47, Part 18

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES (LUMINAIRES)

A. Shall be in accordance with NFPA 70, UL 1598 and shall be as shown on drawings and as specified.

B. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
3. Where lighting fixtures are detailed with minimum 20 gauge housing, minimum 22 gauge housings will be acceptable provided they have strengthening embossed rib and break formations, which give the equivalent rigidity of a 20 gauge housing.
4. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
5. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

D. Lamp Sockets:
   1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Contacts for recessed double contact lampholders and for slimline lampholders shall be silver plated. Lampholders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.
   2. Incandescent: Shall have porcelain enclosures and conform to the applicable requirements of UL 496.
   3. High Intensity Discharge (H.I.D.): Shall have porcelain enclosures.

E. Recessed incandescent fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

F. Fluorescent fixtures with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning and relamping. Vapor tight fixtures shall have pressure clamping devices in lieu of the latches.

G. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

H. Metal Finishes:
   1. The manufacturer shall apply his standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
   2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
   3. Exterior finishes shall be as shown on the drawings.

I. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.

J. Light Transmitting Components for Fluorescent Fixtures:
   1. Shall be 100 percent virgin acrylic plastic or water white, annealed, crystal glass.
   2. Flat lens panels shall have not less than 3.2 mm (1/8 inch) of average thickness. The average thickness shall be determined by

adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.

3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.

K. Lighting Fixtures in Hazardous Areas: Fixtures shall be suitable for installation in flammable atmospheres (Class and Group) as defined in NFPA 70 and shall comply with UL 844.

L. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall be designed for lamps as specified.

2.2 FLUORESCENT LAMP BALLASTS

A. Where applicable, fluorescent lamps and ballasts shall comply with the National Energy Policy Act of 1992.

B. Ballasts shall comply with NEMA 82.1, 82.2 and 82.11, NFPA 70, and UL 935 unless otherwise specified.

C. Lamp types F32T8 and F32T8/U shall be operated by electronic, high frequency ballasts. All other fluorescent lamp types shall be operated by the standard energy saving electromagnetic core-and-coil ballasts. For these applications, the lamps shall be operated by core-and-coil ballasts where specifically required on the drawings as "core-and-coil".

D. Electronic high-frequency ballasts:

1. Ballasts shall operate the lamps at a frequency between 20 and 60 KHz from an input frequency of 60Hz.
2. Ballast package:
   a. Size: The ballast case shall be sized to be physically interchangeable with standard core-and-coil ballasts and suitable for standard mounting in new or existing lighting fixtures.
   b. Case marking: Mark the ballast to indicate the required supply voltage, frequency, RMS current, current surge during starting, input watts, and power factor at the design center voltage, open circuit voltage, crest factor and efficacy.
3. Performance:
   a. Light output:
      1) At the design voltage, the light output shall be at least equal to that obtained by a core-and-coil ballasted system meeting

ANSI, NEMA and CBM standards. The comparison test shall be measured in the same fixture at 25 degrees C (plus or minus one degree) ambient room temperature.

2) Tests shall be made in fixtures designed only for the number of lamps being tested.

3) For other applications (higher ambients, etc.) the tests should be operated with equivalent lamp wall temperatures plus or minus 4 degrees C.

b. Efficacy: The efficacy of the high-frequency, electronically ballasted system shall be at least 15 percent greater than the equivalent CBM core-and-coil ballasted system (see "Light output" above).

c. Starting: The ballast shall be capable of starting and maintaining operation of lamps at an ambient temperature of 10 degrees C (50 degree F) or more for an input voltage of plus or minus 10 percent about the center design voltage unless otherwise indicated. The ballast shall never be started in the instant start mode at any temperature.

d. Operation:

1) The ballast shall safely and reliably operate in a room ambient temperature from 10 degrees C (50 degree F) to 40 degrees C (105 degree F).

2) The light output shall not vary by more than plus or minus 5 percent for a plus or minus 10 percent variation of the input voltage about the center design voltage. Light output shall remain constant for a plus or minus 5 percent variation of the input voltage.

3) The ballast shall operate the lamps in a manner that will not adversely curtail the normal life of the lamp.

e. Transient protection: The ballast shall comply with IEEE C62.41, Cat. A.

f. Flicker: The flicker shall be less than 5 percent and without visible flicker.

g. Noise: The audible noise levels should be equivalent to or better than the Class A rating of CBM certified ballasts.

h. Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI): The EMI and RFI limits shall meet the requirements of the Federal Communications Commission Rules and Regulations (CFR 47 Part 18).

i. Rated life: The ballast shall have a rated life of 10 years or 30,000 hours (based on a 10 hour day).

j. The two-lamp ballast shall safely operate two F32T8 RS, 32- watt lamps or two F32T8/U lamps. The single lamp ballast shall safely operate one F32T8 RS, 32-watt lamp or one F32T8/U lamp.

k. Power factor: Not less than 95 percent.

l. Reliability:

1) Labels: Ballasts must be labeled or listed by UL and CBM/ETL.

2) Submit, simultaneously with shop drawings, a certified test report by an independent testing laboratory showing that the electronic ballasts meet or exceed all the performance requirements in this specification.

m. Total harmonic distortion (THD) shall be less than 10 percent.

E. Core-and-coil ballasts (for lamps other than F32T8 and F32T8/U or where shown on drawings as "core-and-coil"):

1. Shall be rapid starting type.
2. Shall comply with NEMA 82.1 and UL 935.
3. Shall be UL Class P with automatic-resetting, internal, thermal protection.
4. Shall be CBM/ETL certified.
5. Power factor shall be not less than 95 percent. Capacitors in ballasts shall not contain PCB (Polychlorinated Biphenyl) fluids or other fluids recognized as hazardous when discharged into the environment.
6. Sound ratings shall be Class A or better, except for ballast sizes which are not available with Class A ratings, as standard products from any manufacturer. Ballasts which are not available with Class A ratings shall have the quietest ratings available.
7. Where core-and-coil ballasts are specified or detailed in lieu of the normally required electronic high-frequency types, two lamp ballasts shall be energy-saving type, UL listed to operate F40T12 rapid start lamps for both standard 40 watt lamps and the reduced wattage 35/34 watts energy-saving lamps. Lamp output shall be within 5 percent of nominal rating. When operating energy-saving lamps, the input watts to the ballast shall not exceed 78 watts at 120 V.A.C. or 79 watts at 277 V.A.C. Energy-saving type ballasts should not be used in ambient temperatures below manufacturer's recommendations.

F. Ballasts for lighting fixtures controlled by dimming devices shall be the electronic, high frequency type as specified herein, equipped for dimming and conform to the recommendations of the manufacturer of the

associated dimming devices to assure satisfactory operation of the lighting system.

G. All ballasts serving straight or "U" type lamps shall be mounted by four non-turning studs (or captive bolts) equipped with lock washers and nuts or locking type nuts, or by four thread cutting (TC) sheet metal screws which are firmly secured against the fixture body (or wireway) to maximize dissipation of heat and minimize noise. Exception: electronic high-frequency ballasts may be mounted at a minimum of two points, one at each end of unit.

H. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

I. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.

J. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.

2.3 BALLASTS FOR HIGH INTENSITY DISCHARGE FIXTURES:

A. Shall comply with NEMA 82.4 and UL 1029.

B. Shall have individual overcurrent protection sized in accordance with the manufacturer's recommendations.

C. Shall have integral thermal protection where the fixture is recessed in an interior ceiling.

D. Shall be the constant wattage, high power factor type or the reactor high power factor type. Capacitors shall not contain PCB (Polychlorinated Biphenyl) fluids or other fluids recognized as hazardous when discharged into the environment.

E. Shall have not less than Class B sound ratings for interior fixtures, when available. Ballasts which are not available with Class B ratings shall be of the next standard rating.

2.4 LAMPS

A. Fluorescent Lamps:
   1. Rapid start fluorescent lamps shall comply with ANSI C78.1; preheat-start type shall comply with ANSI C78.2; and instant-start and cold-cathode lamps shall comply with ANSI C78.3.
   2. Chromacity of fluorescent lamps shall comply with ANSI C78.376.
   3. The lamps shall include the F32T8, F32T8/U 32 watt energy saving type and EPACT approved F40T12 type if specifically required by contract drawings for special applications.
   4. Except as indicated below, lamps shall be energy saving type, have a color temperature between 3500 and 4100°K, a Color Rendering Index (CRI) of not less than 75, and an initial lumen output not less than 2800. "U" tube lamps shall have the same color temperature and CRI limits as the above.
      a. In utility areas (Electrical, Communication and Mechanical Service rooms and closets), maintenance closets and non-medical storage spaces, utilize energy saving light-white lamps.
      b. In areas with ambient temperatures below 60 degrees use the 40 watt version of the lamp above.
      c. Other areas as indicated on the drawings.

B. Incandescent lamps shall be the general service, inside frosted type rated 130 volts except where otherwise shown on the drawings.

C. High Intensity Discharge Lamps:
   1. Multi-vapor lamps shall be as defined on the detail drawings.
   2. High pressure sodium lamps shall be as defined on the detail drawings.

D. Compact Fluorescent Lamps: Shall be 4100°K, 10,000 hours average rated life, and as follows:
   1. T4, twin tube, rated as indicated.
   2. T4, double twin tube rated as indicated.

2.5 OCCUPANT SENSOR LIGHTING CONTROL SYSTEMS

A. General: An active or passive sensor shall be utilized to control the "On-Off" actuation of fluorescent or incandescent lighting loads. It shall provide control of an isolated set of contacts on exposure to a perceived change in environmental conditions indicating the presence or absence of one or more persons. It shall maintain the contacts closed in the presence of continued changes (due to human presence) at similar intensity and rate. It shall open the contacts at a nominal time after the changes cease.

B. Passive Sensor System: Sensor(s) shall react to changes of radiated infrared energy, indicating the activity of one or more human bodies in the area covered:
   1. Range of detection: The sensor(s) shall provide effective coverage of a room, sensing the presence of one or more people in the room in order to turn the lights on. The ceiling mounted sensor's area of coverage shall be approximately a 4200 mm (14 feet) diameter circle at 1800 mm (6 feet) away. Provide sufficient units to give full coverage as measured 750 mm (30 inches) above the floor. A field-of-view adjustment feature shall be provided to allow orientation to various room operating conditions.
   2. Sensor placement: Locate the sensor(s) in accordance with the manufacturer's recommendations to maximize energy savings by avoiding nuisance activation due to sudden temperature or air flow changes. Locate the units within 1800 mm (6 feet) horizontally of work stations or major points of activity, including the center of room entrance doors.

C. Active Sensor System: Sensor(s) shall react to reflective changes to generated ultrasonic radiation (crystal controlled, 24 to 42kHz), indicating the activity of one or more persons in the area covered.
   1. Range of detection: On ceilings below 3600 mm (twelve feet) in height, a single direction sensor shall cover approximately a 9 x 9 m (30 feet x 30 feet) area; a two directional unit a 18 x 9 m (60 feet x 30 feet) area; and a two-way corridor unit a total distance of 27 m (90 feet). The sensors shall be equipped with a concealed but accessible sensitivity control to tune the unit to specific room conditions.
   2. Sensor placement: Locate the sensor(s) in accordance with the manufacturer's recommendations to maximize energy savings by avoiding nuisance activation due to predictable non-human motion activities. Give particular attention to work station or major areas of activity and the coverage of room entrance doors.

D. Timing/Function: Shall not be user adjustable. Lighting shall remain on with one or more persons within the covered area. The system shall be factory set to maintain lights on for a minimum of 8 minutes and not longer than 12 minutes after the area of coverage is vacated. For testing purposes, there shall be a means to change the pre-set time delay to 30 seconds or less.

E. Control Unit: The system shall have a switching relay(s) capable of switching the fluorescent or incandescent loads as required. Contacts

shall be rated at a minimum of 15 Amps at voltages to 277, with expected cycles of operation in excess of 100K. Power derived from a current limiting 24 volt transformer shall power the system and the unit must be packaged for installation on a standard 200 mm x 200 mm (4 inch x 4 inch) NEMA box enclosure. The unit shall be wired through a conventional wall switch to provide an over-ride system "Off" and active "Off-On" functioning.

F. Field Wiring: The wiring between the control unit and sensor(s) shall be an insulated multi-conductor, #22 gauge Poly Vinyl Chloride (PVC) jacketed cable.

2.6 EXIT LIGHT FIXTURES

A. Exit light fixtures shall meet applicable requirements of NFPA 101 and UL 924.

B. Housing and Canopy:
   1. Shall be made of cast or extruded aluminum, or rolled steel.
   2. Optional steel housing shall be a minimum 20 gauge thick or equivalent strength aluminum.
   3. Steel housing shall have baked enamel over corrosion resistant, matte black or ivory white primer.

C. Door frame shall be cast or extruded aluminum, and hinged with latch.

D. Finish shall be satin or fine-grain brushed aluminum.

E. There shall be no radioactive material used in the fixtures.

F. Fixtures:
   1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous red Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass. The LED shall be rated minimum 25 years life; maximum of 3.5 watts for single face and 7 watts for double-faced fixtures that do not use diffuser panels in front of the LEDs. LED exit light fixtures that use diffuser panels shall require a maximum of 1.0 watt per fixture for single or double face fixtures.
   2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
   3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltages: Fixtures shall be wired for 277-volt operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.

B. Align, mount and level the lighting fixtures uniformly.

C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Resident Engineer.

D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.

E. Fluorescent bed light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable.

F. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed fluorescent fixtures:
   a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
   b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.
5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
   a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than

6 mm (1/4 inch) secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.

b. In addition to being secured to any required outlet box, fixtures shall be bolted to a plaster ceiling at four points spaced near the corners of each fixture. Pre-positioned 6 mm (1/4 inch) studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 6 mm (1/4 inch) toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

G. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.

H. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

I. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

J. At completion of project, relamp all fixtures which have failed/burned-out lamps. Clean all fixtures, lenses, diffusers and louvers that have accumulated dust/dirt during construction.

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SECTION 27 05 11
REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section, Requirements for Communications Installations, applies to all sections of Division 27.

B. Furnish and install communications cabling, systems, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of transformers, cable, and other items and arrangements for the specified items are shown on drawings.

1.2 MINIMUM REQUIREMENTS

A. References to industry and trade association standards and codes are minimum installation requirement standards.

B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.4 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the VA through the Contracting Officer Technical Representative (COTR) a minimum of (15) working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the COTR prior to final inspection and not more than(90) days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the Contractor shall be liable for all additional expenses, including expenses of the Government.

1.5 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with Section 00 72 00, GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.6 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.

2. Damaged equipment shall be, as determined by the COTR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
3. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.7 WORK PERFORMANCE

A. Job site safety and worker safety is the responsibility of the Contractor.

B. For work on existing stations, arrange, phase and perform work to assure communications service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

D. Coordinate location of equipment and pathways with other trades to minimize interferences. See Section 00 72 00, GENERAL CONDITIONS.

1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.9 EQUIPMENT IDENTIFICATION

A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4 inch) high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as

a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.10 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage, or installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings, and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.

2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the

technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.

2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation and maintenance instructions.
   e. Safety precautions.
   f. Diagrams and illustrations.
   g. Testing methods.
   h. Performance data.
   i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
   j. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

G. Approvals will be based on complete submission of manuals together with shop drawings.

H. After approval and prior to installation, furnish the COTR with one sample of each of the following:
   1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
   2. Each type of conduit and pathway coupling, bushing and termination fitting.
   3. Raceway and pathway hangers, clamps and supports.

4. Duct sealing compound.

I. In addition to the requirement of SUBMITTALS, the VA reserves the right to request the manufacturer to arrange for a VA representative to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.

1.11 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.12 TRAINING

A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Training shall be provided for the particular equipment or system as required in each associated specification.

C. A training schedule shall be developed and submitted by the contractor and approved by the COTR at least 30 days prior to the planned training.

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SECTION 27 05 33
RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for all communications cabling unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Sealing around penetrations to maintain the integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.

B. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

C. General electrical requirements and items that is common to more than one section of Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

D. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

A. Shop Drawings:

1. Size and location of panels and pull boxes
2. Layout of required conduit penetrations through structural elements.
3. The specific item proposed and its area of application shall be identified on the catalog cuts.

B. Certification: Prior to final inspection, deliver to the Contracting Officer Technical Representative (COTR) four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. National Fire Protection Association (NFPA):

70-05.....National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL):

1-03.....Flexible Metal Conduit
5-01.....Surface Metal Raceway and Fittings
6-03.....Rigid Metal Conduit
50-03.....Enclosures for Electrical Equipment
360-03.....Liquid-Tight Flexible Steel Conduit
467-01.....Grounding and Bonding Equipment
514A-01.....Metallic Outlet Boxes
514B-02.....Fittings for Cable and Conduit
514C-05.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-02.....Schedule 40 and 80 Rigid PVC Conduit
651A-03.....Type EB and A Rigid PVC Conduit and HDPE Conduit
797-03.....Electrical Metallic Tubing
1242-00.....Intermediate Metal Conduit

D. National Electrical Manufacturers Association (NEMA):

TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and Tubing
FB1-03.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 19 mm (3/4 inch) unless otherwise shown. Where permitted by the NEC, 19 mm (3/4 inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
2. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.
3. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.
4. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.
5. Flexible galvanized steel conduit: Shall Conform to UL 1.
6. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
7. Surface metal raceway: Shall Conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
   a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
   a. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
   e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Rigid aluminum conduit fittings:
   a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
   b. Locknuts and bushings: As specified for rigid steel and IMC conduit.
   c. Set screw fittings: Not permitted for use with aluminum conduit.
3. Electrical metallic tubing fittings:
   a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set

screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

d. Indent type connectors or couplings are prohibited.

e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

4. Flexible steel conduit fittings:

a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.

b. Clamp type, with insulated throat.

5. Liquid-tight flexible metal conduit fittings:

a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.

b. Only steel or malleable iron materials are acceptable.

c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

6. Surface metal raceway fittings: As recommended by the raceway manufacturer.

7. Expansion and deflection couplings:

a. Conform to UL 467 and UL 514B.

b. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.

d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:

1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.

2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

3. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.

4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:
1. UL-50 and UL-514A.
2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
4. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:
1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COTR prior to drilling through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COTR as required by limited working space.

B. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

3.2 INSTALLATION, GENERAL

A. Install conduit as follows:
1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically continuous.

6. Independently support conduit at 8’0” on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Do not use aluminum conduits in wet locations.
12. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

B. Conduit Bends:
1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

C. Layout and Homeruns:
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COTR.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only when the following occurs:
   a. Where shown on the structural drawings.
   b. As approved by the COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
   a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
   b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
   c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:
   1. Conduit for conductors above 600 volts:
      a. Rigid steel or rigid aluminum.
      b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
   2. Conduit for conductors 600 volts and below:
      a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
   3. Align and run conduit parallel or perpendicular to the building lines.
   4. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
B. Conduit for conductors above 600 volts:
   1. Rigid steel or rigid aluminum.
   2. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
C. Conduit for Conductors 600 volts and below:
   1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
D. Align and run conduit parallel or perpendicular to the building lines.
E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
F. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.

G. Surface metal raceways: Use only where shown.

H. Painting:

1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 EXPANSION JOINTS

A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.

C. Install expansion and deflection couplings where shown.

3.6 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
2. Existing Construction:
   a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.

b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts are permitted.
G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.7 BOX INSTALLATION

A. Boxes for Concealed Conduits:
1. Flush mounted.
2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
D. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

3.11 COMMUNICATION SYSTEM CONDUIT

A. Install the communication raceway system as shown on drawings.
B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.
C. All conduit ends shall be equipped with insulated bushings.
D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

G. Were drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

H. All empty conduits located in communication closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

J. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

- - - E N D - - -

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating extension of the existing Voice and Digital Cable Distribution System (here-in-after referred to as "*the* S*ystem*"), and associated equipment and hardware to be installed in the VA Medical Center here-in-after referred to as "the Facility". The System shall include, but not be limited to: equipment cabinets, interface enclosures, and relay racks; necessary combiners, traps, and filters; and necessary passive devices such as: splitters, couplers, cable "patch", "punch down", and cross-connector blocks or devices, voice and data distribution sub-systems, and associated hardware. The System shall additionally include, but not be limited to: telecommunication closets (TC); telecommunications outlets (TCO); copper and fiber optic distribution cables, connectors, "patch" cables, and/or "break out" devices.

B. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.

C. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.

D. The Voice and Digital Telecommunication Distribution Cable Equipment and System provides the media which voice and data information travels over and connects to the Telephone System which is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Therefore, since the System connects to or extends the telephone system, the System's installation and operation shall adhere to all appropriate National, Government, and/or Local Life Safety and/or Support Codes, which ever are the more stringent for this Facility. At a minimum , the System shall be installed according to NFPA, Section 70, National Electrical Code (NEC), Article 517 and Chapter 7; NFPA, Section 99, Health Care Facilities, Chapter 3-4; NFPA, Section 101, Life Safety Code, Chapters 7, 12, and/or 13; Joint Commission on Accreditation of Health Care

Organization (JCAHCO), Manual for Health Care Facilities, all necessary Life Safety and/or Support guidelines; this specification; and the original equipment manufacturer's (OEM) suggested installation design, recommendations, and instructions. The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of this specification before the System is designed, engineered, delivered, and provided.

E. The VA Project Manager (PM) and/or if delegated, Contracting Officer Technical Representative (COTR) are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the COTR before proceeding with the change.

F. System Performance:

1. At a minimum, the System shall be able to support the following voice and data operations for Category 6 Certified Telecommunication Service:
   a. Provide the following interchange (or interface) capabilities:
      1) Basic Rate (BRI).
      2) Primary Rate (PRI).
   b. ISDN measured at:
      1) Narrow Band BRI:
         a) B Channel: 64 kilo-Bits per second (kBps), minimum.
         b) D Channel: 16 kBps, minimum.
         c) H Channel: 384 kBps, minimum.
      2) Narrow Band PRI:
         a) B Channel: 64 kBps, minimum.
         b) D Channel: 64 kBps, minimum.
         c) H Channel: 1,920 kBps, minimum.
      3) Wide (or Broad) Band: All channels: 140 mega(m)-Bps, minimum, capable to 565 mBps at “T” reference.
   c. ATM operation and interface: ATM 155 mBps.
   d. Frame Relay: All stated compliance’s measured.
   e. Integrated Data Communications Utility (IDCU) operation and interface.
   f. Government Open Systems Interconnection Profile (GOSSIP) compliant.

g. Fiberoptic Distributed Data Interface (FDDI): A minimum 100 mBps to a maximum of 1.8 giga(g)-Bps data bit stream speed.(Shall be Synchronous Optical Network [SONET] compliant).

h. System Sensitivity: Satisfactory service shall be provided for at least 3,000 feet for all voice and data.

2. At a minimum the System shall support the following operating parameters:

a. EPBX connection:

1) System speed: 1.0 gBps per second, minimum.

2) Impedance: 600 Ohms.

3) Cross Modulation: -60 deci-Bel (dB).

4) Hum Modulation: -55 dB.

5) System data error: 10 to the -10 Bps, minimum.

6) Loss: Measured at the frame output with reference Zero (0) deciBel measured (dBm) at 1,000 Hertz (Hz) applied to the frame input.

a) Trunk to station: 1.5 dB, maximum.

b) Station to station: 3.0 dB, maximum.

c) Internal switch crosstalk: -60 dB when a signal of ± 10 deciBel measured (dBm), 500-2,500 Hz range is applied to the primary path.

d) Idle channel noise: 25 dBm “C” or 3.0 dBm “O” above reference (terminated) ground noise, whichever is greater.

e) Traffic Grade of Service for Voice and Data:

(1) A minimum grade of service of P-01 with an average traffic load of 7.0 CCS per station per hour and a traffic overload in the data circuits will not interfere with, or degrade, the voice service.

(2) Average CCS per voice station: The average CCS capacity per voice station shall be maintained at 7.0 CCS when the EPBX is expanded up to the projected maximum growth as stated herein.

b. Telecommunications Outlet (TCO):

1) Voice:

a) Isolation (outlet-outlet): 24 dB.

b) Impedance: 600 Ohms, balanced (BAL).

c) Signal Level: 0 deciBel per mili-Volt (dBmV) ± 0.1 dBmV.

d) System speed: 100 mBps, minimum.

e) System data error: 10 to the -6 Bps, minimum.

2) Data:

a) Isolation (outlet-outlet): 24 dB.

b) Impedance: 600 Ohms, BAL.

c) Signal Level: 0 dBmV ± 0.1 dBmV.

d) System speed: 120 mBps, minimum.

e) System data error: 10 to the -8 Bps, minimum.

3) Fiber optic:

a) Isolation (outlet-outlet): 36 dB.

b) Signal Level: 0 dBmV ± 0.1 dBmV.

c) System speed: 540 mBps, minimum.

d) System data error: 10 to the -6 bps, minimum.

1.2 RELATED WORK

A. Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Specification Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

C. Specification Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

D. Specification Section 27 10 00, STRUCTURED CABLING.

E. Specification Section 26 27 26, WIRING DEVICES.

F. Specification Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

G. Specification Section 27 31 31, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT - EXTENSION.

H. H-088-C3 VA HANDBOOK DESIGN FOR TELEPHONE SYSTEMS

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date the system’s submittal is technically approved by VA, shall be enforced.

B. National Fire Protection Association (NFPA):

70	NATIONAL ELECTRICAL CODE (NEC)
75	Protection of Electronic Computer/Data Processing Equipment
77	Recommended Practice on Static Electricity
	Standard for Health Care Facilities
101	Life Safety Code
1221	Emergency Services Communication Systems

C. Underwriters Laboratories, Inc. (UL):

65	Wired Cabinets
96	Lightning Protection Components
96A	INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS
467	Grounding and Bonding Equipment
497/497A/497B	PROTECTORS FOR PAIRED CONDUCTORS/ COMMUNICATIONS CIRCUITS/DATA COMMUNICATIONS AND FIRE ALARM CIRCUITS
884	Underfloor Raceways and Fittings

D. ANSI/EIA/TIA Publications:

568B	Commercial Building Telecommunications Wiring Standard
569B	Commercial Building Standard for Telecommunications Pathways and Spaces
606A	ADMINISTRATION STANDARD FOR THE TELECOMMUNICATIONS INFRASTRUCTURE OF COMMERCIAL BUILDINGS
607A	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
758	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings

E. Lucent Technologies: Document 900-200-318 “Outside Plant Engineering Handbook”.

F. International Telecommunication Union – Telecommunication Standardization Sector (ITU-T).

G. Federal Information Processing Standards (FIPS) Publications.

H. Federal Communications Commission (FCC) Publications: Standards for telephone equipment and systems.

I. United States Air Force: Technical Order 33K-l-lOO Test Measurement and Diagnostic Equipment (TMDE) Interval Reference Guide.

J. Joint Commission on Accreditation of Health Care Organization (JCAHO): Comprehensive Accreditation Manual for Hospitals.

K. National and/or Government Life Safety Code(s): The more stringent of each listed code.

1.4 QUALITY ASSURANCE

A. The authorized representative of the OEM, shall be responsible for the design, satisfactory total operation of the System, and its certification.

B. The OEM shall meet the minimum requirements identified in Paragraph 2.1.A. Additionally, the Contractor shall have had experience with three or more installations of systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identification of these installations shall be provided as a part of the submittal as identified in Paragraph 1.5.

C. The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment. In addition, the OEM and System Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certification must be provided in writing as part of the Contractor’s Technical Submittal.

D. All equipment, cabling, terminating hardware, TCOs, and patch cords shall be sourced from the certifying OEM or at the OEM’s direction, and support the System design, the OEM’s quality control and validity of the OEM’s warranty.

E. The Contractor’s Telecommunications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the COTR before being allowed to commence work on the System.

1.5 SUBMITTALS

A. Provide submittals in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. The COTR shall retain one copy for review and approval.
   1. If the submittal is approved the COTR shall retain one copy for Official Records and return three (3) copies to the Contractor.
   2. If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached that indicates the areas the submittal deviated from the System specifications. The RE shall retain one copy for Official Records.

B. Environmental Requirements: Technical submittals shall confirm the environmental specifications for physical TC areas occupied by the System. These environmental specifications shall identify the requirements for initial and expanded system configurations for:
   1. Floor loading for batteries and cabinets.
   2. Minimum floor space and ceiling heights.
   3. Minimum size of doors for equipment passage.
   4. Power requirements: The Contractor shall provide the specific voltage, amperage, phases, and quantities of circuits required.
   5. Air conditioning, heating, and humidity requirements. The Contractor shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.
   6. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).
   7. Proposed floor plan, based on the expanded system configuration of the bidder's proposed EPBX for this FACILITY.
   8. Conduit size requirement (between main TC, computer, and console rooms).
   9. Main backbone, trunk line, riser, and horizontal cable pathways, cable duct, and conduit requirements between each MTC, TC, and TCO.

C. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:
   1. Title page to include:
      a. VA Medical Center.
      b. Contractor’s name, address, and telephone (including FAX) numbers.

c. Date of Submittal.

d. VA Project No.

2. List containing a minimum of three locations of installations of similar size and complexity as identified herein. These locations shall contain the following:
   a. Installation Location and Name.
   b. Owner’s or User’s name, address, and telephone (including FAX) numbers.
   c. Date of Project Start and Date of Final Acceptance by Owner.
   d. System Project Number.
   e. Brief (three paragraphs minimum) description of each system’s function, operation, and installation.
3. Narrative Description of the system.
4. A List of the equipment to be furnished. The quantity, make, and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system. Delete equipment items that are not required add additional items required, and renumber section as per system design. The following is the minimum equipment required by the system:

QUANTITY	UNIT
As required	Cabinet Assembly(s)
As required	Environmental Cabinet
As required	Distribution/Interface Cabinet
As required	Equipment (Radio Relay) Rack
As required	Cross Connection (CCS) Systems
As required	Audio Alarm Panel
As required	TROUBLE ANNUNCIATOR PANEL
As required	Lightning Protection System
As required	Wire Management System/Equipment
As required	Telecommunications Outlets (TCO)
As Required	Distribution Cables
As required	TCO Connection Cables
As required	System Connectors
As required	Terminators
As required	Distribution Frames
As required	Telecommunications Closets (TC)

As required	Environmental Requirements
1 ea.	Installation Kit
As-required	Separate List Containing Each Equipment Spare(s)

5. Pictorial layouts of each MTC, IMTC, and RTCs; MCCS, IMCCS, VCCS, and HCCS termination cabinet(s), each distribution cabinet layout drawing, and TCO as each is expected to be installed and configured.
6. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
7. Engineering drawings of the System, showing calculated signal levels at the EPBX output, each input and output distribution point, proposed TCO values, and signal level at each TCO multipin and fiberoptic jack.
8. List of test equipment as per paragraph 1.5.D. below.
9. Letter certifying that the Contractor understands the requirements of the SAMPLES Paragraph 1.5.E.
10. Letter certifying that the Contractor understands the requirements of Section 3.2 concerning acceptance tests.

D. Test Equipment List:

1. The Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.
2. The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
   a. Spectrum Analyzer.
   b. Signal Level Meter.
   c. Volt-Ohm Meter.
   d. Time Domain Reflectometer (TDR) with strip chart recorder (Data and Optical Measuring).
   e. Bit Error Test Set (BERT).

f. Camera with a minimum of 60 pictures to that will develop immediately to include appropriate test equipment adapters. A video camera in VHS format is an acceptable alternate.

E. Samples: A sample of each of the following items shall be furnished to the RE for approval prior to installation.

1. TCO Wall Outlet Box 4" x 4"x 2.5" with:
   a. One each telephone (or voice) RJ45 jack installed.
   b. Two each multi pin data RJ45 jacks installed.
   c. Cover Plate installed.
2. Data CCS patch panel, punch block or connection device with RJ45 connectors installed.
3. Telephone CCS system with IDC and/or RJ45 connectors and cable terminal equipment installed.
4. Fiber optic CCS patch panel or breakout box with cable management equipment and “ST” connectors installed.
5. 610 mm (2 ft.) section of each copper cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
6. 610 mm (2 ft.) section of each fiber optic cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.

F. Certifications:

1. Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.
2. Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Government Life Safety Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.
3. Preacceptance Certification: This certification shall be made in accordance with the test procedure outlined in paragraph 3.2.B.

G. Equipment Manuals: Fifteen (15) working days prior to the scheduled acceptance test, the Contractor shall deliver four complete sets of

commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the COTR. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams, and parts list.

H. Record Wiring Diagrams:

1. Fifteen (15) working days prior to the acceptance test, the Contractor shall deliver four complete sets of the Record Wiring Diagrams of the System to the COTR. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, Equipment and room/area locations.
2. The Record Wiring Diagrams shall be in hard copy and two compact disk (CD) copies properly formatted to match the Facility’s current operating version of Computer Aided Drafting (AutoCAD) system. The COTR shall verify and inform the Contractor of the version of AutoCAD being used by the Facility.

I. Surveys Required As A Part Of The Technical Submittal: The Contractor shall provide the following surveys that depict various system features and capacities are required in addition to the on site survey requirements described herein. Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal survey requirements), as a minimum:

1. The required EPBX connections (each CSU shall be compatible with) shall be compatible with the following:
   a. Initially connect:

EQUIPPED ITEM	CAPACITY	WIREDCAPACITY
Main Station Lines	As Required	As Required
Single Line	As Required	As Required
Multi Line (Equipped for direct input dial [DID])	As Required	As Required
Central Office (CO) Trunks	As Required	As Required
TWO WAY	As Required	As Required
DID	As Required	As Required
Two-way DRTL	As Required	As Required

Foreign Exchange (FX)	As Required	As Required
Conference	As Required	As Required
Radio Paging Access	As Required	As Required
Audio Paging Access	As Required	As Required
Off-Premise Extensions	As Required	As Required
CO Trunk By-pass	As Required	As Required
CRT w/keyboard	As Required	As Required
Printers	As Required	As Required
Attendant Consoles	As Required	As Required
T-1 Access/Equipment	As Required	As Required
Maintenance console	As Required	As Required

b. Projected Maximum Growth: The Contractor shall clearly and fully indicate this category for each item identified in Paragraph 1.4.H.1.a. as a part of the technical submittal. For this purpose, the following definitions and sample connections are provided to detail the system’s capability:

EQUIPPED ITEM	CAPACITY	WIRED CAPACITY
Servers	As Required	As Required
PC’s	As Required	As Required
Projected Maximum Growth	As Required	As Required

The Contractor shall clearly and fully indicate this category for each item identified in Paragraph 1.4.H.2.a. as a part of the technical submittal.

2. Cable Distribution System Design Plan: A design plan for the entire cable distribution systems requirements shall be provided with this document. A specific cable count shall coincide with the total growth items as described herein. It is the Contractor’s responsibility to provide the Systems entire cable requirements and engineer a distribution system requirement plan using the format of the following paragraph(s), at a minimum:

a. UTP (and/or STP) Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from
BUILDING	Identifies the building by number, title, or location cabling is to be provided in
TO BUILDING IMC	Identifies building main terminal signal closet, by room number or location, to which cabling is provided too, in, and from
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.) cabling and TCOs are to be provided
TC ROOM NUMBER	Identifies the floor signal closet room, by room number, which cabling shall be provided
ROOM NUMBER	Identifies the room, by number, from which cabling and TCOs shall be provided
NUMBER OF CABLE PAIR	Identifies the number of cable pair required to be provided on each floor designated OR the number of cable pair (VA Owned) to be retained
NUMBER OF STRANDS USED/SPARE	Identifies the number of strands provided in each run

b. Fiber Optic Cabling Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from
TO BUILDING IMC	Identifies building, by number, title, or location, to which cabling is provided
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.)
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
NUMBER OF STRANDS	Identifies the number of strands in each run of fiber optic cable
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment

BUILDING MTC	Identifies the building by number or title

3. Telecommunication Outlets: The Contractor shall clearly and fully indicate this category for each outlet location and compare the total count to the locations identified above as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. System Requirements:

1. The System shall provide the following minimum services that are designed in accordance with and supported by an Original Equipment Manufacturer (OEM), and as specified herein. The System shall provide continuous inter and/or intra-Facility voice and data service. The System shall be capacity sized so that loss of connectivity to external telephone systems shall not affect the Facilities operation in specific designated locations. The System shall:
   a. Be capable of inter-connecting and functioning fully with the existing Local Telephone Exchange (LEC) Network(s), Federal Telephone System (FTS) Inter-city Network(s), Inter-exchange Carriers, Integrated Services Digital Network (ISDN), Electronic Private Branch Exchange (EPBX) switches, asynchronous/synchronous data terminals and circuits including Automatic Transfer Mode (ATM), Frame Relay, and local area networks (LAN), at a minimum.
   b. Be a voice and data cable distribution system that is based on a physical “Star” Topology.
   c. Be compatible with and able to provide direct digital connection to trunk level equipment including, but, not limited to: directly accessing trunk level equipment including the telephone system, audio paging, Industry Standard “T” and/or “DS” carrier services and external protocol converters. Additionally, connections to “T” and/or “DS” access/equipment or Customer Service Units (CSU) that are used in FTS and other trunk applications shall be included in the System design. Provide T-1 access/equipment (or CSU), as required for use, in FTS and other trunk applications by system design if this equipment is not provided by the existing

telephone system and/or will be deactivated by the installation of the System. The Contractor shall provide all T-1 equipment necessary to terminate and make operational the quantity of circuits designated. The CSU's shall be connected to the System's emergency battery power supply. The System shall be fully capable of operating in the Industry Standard "DS" protocol and provide that service when required.

d. Where the System connects to an existing or future telephone system, refer to specification Section 27 31 31, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT - EXTENSION for specific telephone equipment and system operational performance standards.

2. Cable Systems - Twisted Pair and Fiber optic

a. General:

1) The Contractor shall be responsible for providing a new system conforming to current and accepted telephone and digital industrial/commercial cable distribution standards. The distribution cable installation shall be fully coordinated with the Facility, the PM, the COTR and the Contractor prior to the start of installation.

2) The Contractor is responsible for complete knowledge of the space and cable pathways (i.e. equipment rooms, TCs, conduits, wireways, etc.) of the Facility. The Contractor shall at a minimum design and install the System using the Pathway Design Handbook H-088C3, TIA/EIA Telecommunications Building Wiring Standards, and Facility Chief of Information Resource Management's (IRM) instructions, as approved in writing by the PM and/or COTR.

3) The System cables shall be fully protected by cable duct, trays, wireways, conduit (rigid, thin wall, or flex), and when specifically approved, flexible innerduct. It is the responsibility of the Contractor to confirm all contract drawings and the Facility's physical layout to determine the necessary cable protective devices to be provided. If flexible innerduct is used, it shall be installed in the same manner as conduit.

4) Cable provided in the system (i.e. backbone, outside plant, inside plant, and station cabling) shall conform to accepted industry and OEM standards with regards to size, color code, and insulation. The pair twists of any pair shall not be exactly the same as any other pair within any unit or sub-unit of cables that are bundled in twenty-five (25) pairs or less. The absence of specifications regarding details shall imply that best general industry practices shall prevail and that first quality material and workmanship shall be provided. Certification Standards, (i.e., EIA, CCITT, FIPPS, and NFPA) shall prevail.
5) Some areas of this Facility may be considered “plenum”. All wire and cable used in support of the installation in those areas (if any) shall be in compliance with national and local codes pertaining to plenum environments. It is the responsibility of the Contractor to review the VA’s cable and wire requirements with the RE and the IRM prior to installation to confirm the type of environment present at each location.
6) The Contractor shall provide outside and inside plant cables that furnishes the number of cable pairs required in accordance with the System requirements described herein. The Contractor shall fully coordinate and obtain approval of the design with the OEM, COTR and the IRM prior to installation.
7) All metallic cable sheaths, etc. shall be grounded by the Contractor (i.e.: risers, underground, station wiring, etc.) as described herein.
8) If temporary cable and wire pairs are used, they shall be installed so as to not present a pedestrian safety hazard and the Contractor shall be responsible for all work associated with the temporary installation and for their removal when no longer necessary. Temporary cable installations are not required to meet Industry Standards; but, must be reviewed and approved by the COTR and the IRM prior to installation.
9) Conductors shall be cabled to provide protection against induction in voice and data circuits. Crosstalk attenuation

within the System shall be in excess of -80 dB throughout the frequency ranges specified.

10) Measures shall be employed by the Contractor to minimize the radiation of RF noise generated by the System equipment so as not to interfere with audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.

11) The System's cables shall be labeled on each end and been fully tested and certified in writing by the Contractor to the RE before proof of performance testing can be conducted. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs. Minimum test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges specified. The tests required for data cable must be made to guarantee the operation of this cable at not less than 10 mega (m) Hertz (Hz) full bandwidth, fully channel loaded and a Bit Error Rate of a minimum of 10-6 at the maximum rate of speed. All cable installation and test records shall be made available at acceptance testing by the COTR or Contractor and thereafter maintained in the Facility's Telephone Switch Room. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.

12) The Contractor shall coordinate with the LEC to install the telephone entrance cable to the nearest point of entry into the Facility and as shown on the drawings. The Contractor shall coordinate with the COTR and the LEC to provide all cable pairs/circuits from the Facility point of entry to the Telephone Switch Room all telephone, FTS, DHCP, ATM, Frame Relay, data, pay stations, patient phones, and any low voltage circuits as described herein.

13) The Contractor shall coordinate with the COTR and the IRM to install the computer interface cable to the Facility Telephone Switch Room from the Facility's Computer Room for all data,

DHCP, FTS, ATM, Frame Relay, and telephone circuits and as shown on the drawings.

14) The Contractor shall coordinate with the COTR and the IRM to provide all cable pairs/circuits from the Facility Telephone Switch Room and establish circuits throughout the Facility for all voice, data, computer alarm (except fire alarm), private maintenance line, Radio Paging, PA, LAN, DHCP, and any low voltage circuits as described herein.

15) The Contractor shall provide proper test equipment to guarantee that cable pairs meet each OEM’s standard transmission requirements, and guarantee the cable will carry data transmissions at the required speeds, frequencies, and fully loaded bandwidth.

b. Telecommunications Closets (TC): In TC’s that are served with both a UTP and STP backbone cable and a fiber optic backbone cable, the UTP and STP cable shall be terminated on separate RJ-45, 8-pin connectors with 110A or equivalent type punch down blocks located on the back or front of a 48-port modular patch panel dedicated to data applications. Only the UTP and STP backbone cable pairs, identified as being connected to the fiber optic backbone, shall be extended to the fiber optic interface device. All connecting cables required to extend these cables (i.e. patch cords, twenty-five pair connectors, etc.), to the fiber optic interface device, in the TC’s shall also be provided by the Contractor to insure a complete and operational fiber optic distribution system:

1) In TC’s, which are only served by a UTP and STP backbone cable, the cable shall be terminated on separate modular connecting devices (110A or equivalent) that are dedicated to data applications. In order to provide full service to all data cable pairs as identified in each TC/cabinet including spare capacity noted herein, the size of all vertical (riser) cables and/or outside cables serving these TC’s shall be increased as required.

c. Backbone and Trunk Cables:

1) The Contractor shall identify, in the technical submittal, the voice and data (analog RF coaxial cable shall not be provided

in main trunk or backbone lines) connecting arrangements required by the LEC for interconnection of the System to the commercial telephone and FTS networks. The Contractor shall provide all required voice and data connecting arrangements.

2) The Contractor shall be responsible for compatibility of the proposed TCs (to be compliant with the EPBX and CSU equipment) numbering scheme with the numbering plan for the FTS, DID, local stations, and the North American Numbering Plan. The Contractor shall consult with the VA and the LEC regarding the FTS and North American Numbering plan to be implemented for the Facility to ensure system compatibility.

3) All submitted equipment shall meet or exceed standards, rules, and regulations of the Federal Communications Commission (FCC) and shall be capable of operating without outboard or “extra” devices. The Contractor shall identify the FCC registration number of the System equipment, EPBX, and proposed CSU (if known) in the technical submittal.

4) A minimum of one (1) 400 shielded twisted pair (STP) cable shall be installed from the Telephone Switch Room cross connecting system (CCS) to the Main Computer Room MDF. This cable shall support the transmission of data information over twisted pair cable. The cable shall be tested and terminated on a Contractor provided cable management frame, RJ-45 modular jacks with eight (8) pin connectors, and 48 port modular patch panels located in the Main Computer Room and Telephone Switch Room. The cable shall be labeled, terminated, and separated from the other cables on the MDF and Telephone Switch Room CCS. This requirement shall be fully coordinated and approved by the Facility Chief, IRM and the COTR prior to installation. The cabling requirements of this paragraph are in addition to the requirements specified in the System Design Plan identified herein.

d. Riser Cable:

1) All communication riser cables shall be listed as being suitable for the purpose and marked accordingly per Articles 517, 700, and 800 of the NEC.

2) All voice and data communication (analog RF coaxial cable is not to be provided in riser systems) riser cables shall be STP or Unshielded Twisted Pair (UTP), minimum 24 American Wire Gauge (AWG) solid, thermoplastic insulated conductors. They shall be enclosed with a thermoplastic outer jacket.
3) The Contractor shall provide and install inside riser cables to insure full service to all voice cable pairs identified in each TC terminating enclosure plus not less than 50% additional spare capacity.
4) The complete riser cabling system shall be labeled and tested as described herein.

e. Horizontal and Station Cable:
1) A Four (4) UTP 24 AWG station wiring cable shall be installed from the top TCO jack to the TC and shall be of a type designed to support Category 6 communications (250 mega-Hertz [mHz] or above). At the jack location, terminate all four pair on the RJ-45/11 jack. At the signal closet, all four pair shall be terminated on the modular punch down blocks dedicated to telephone applications.
2) A Four (4) UTP 24 AWG (in thermoplastic jacket unless otherwise specified by COTR) station wiring cable shall be installed from each of the two (2) bottom TCO RJ-45 jacks (shall conform to EIA/TIA 568 Standard "T568A" and NFPA) to the TC and shall be of a type designed to support Category 6 communications (250 mHz or above).

f. Telecommunication Outlets (TCO), Jacks: All TCO’s shall have a minimum of three (3) RJ-45 type jacks. The top jack shall be an eight pin RJ-45/11 compatible jack, labeled, and designated for telephone applications only. The bottom two jacks shall be eight pin RJ-45 type unkeyed (sometimes called center keyed) jacks, labeled, and designated for data.

g. Patient Bedside Prefabricated Units (PBPU): Where PBPU’s exist in the Facility, the Contractor shall identify the single gang "box" location on the PBPU designated for installation of the telephone jack. This location shall here-in-after be identified as the PBTCO. The Contractor shall be responsible for obtaining written approval and specific instructions from the PBPU OEM regarding

the necessary disassembly and reassembly of each PBPU to the extent necessary to pull wire from above the ceiling junction box to the PBPU box reserved for the PBTCO. A Contractor provided stainless steel cover plate approved for use by the PBPU OEM and Facility IRM Chief shall finish out the jack installation. Under no circumstances shall the Contractor proceed with the PBPU installations without the written approval of the PBPU OEM and the specific instructions regarding the attachment to or modifying of the PBPU. The COTR shall be available to assist the Contractor in obtaining these approvals and instructions in a timely manner as related to the project's time constraints. It is the responsibility of the Contractor to maintain the UL integrity of each PBPU. If the Contractor violates that integrity, it shall be the responsibility of the Contractor to obtain on site UL re-certification of the violated PBPU at the direction of the RE and at the Contractor's expense.

h. Fiber Optics:

1) A complete fiber optic cable distribution system shall be provided as a part of the System. The Contractor shall provide a fiber optic cable that meets the minimum bandwidth requirements for FDDI, ATM, and Frame Relay services. This fiber optic cable shall be a 62.5/125 micron multi-mode, containing a minimum of 18 strands of fiber, unless otherwise specified, and shall not exceed a distance of 2,000 Meters (M), or 6,560 feet (ft.) in a single run. Loose tube cable, which separates the individual fibers from the environment, shall be installed for all outdoor runs or for any area which includes an outdoor run. Tight buffered fiber cable shall be used for indoor runs. The multimode fibers shall be terminated and secured at both ends in "ST" type female stainless steel connectors installed in an appropriate patch or breakout panel with a cable management system. A 610 mm (2 ft.) cable loop (minimum) shall be provided at each end to allow for future movement.

2) In addition, a 12 strand (minimum), 8.3 mm single mode fiber optic cable shall be provided. Single mode fibers shall be terminated and secured at both ends with "ST" type female

stainless steel connectors installed in an appropriate patch or breakout panel. The panel shall be provided with a cable management system. A 610 mm (2 ft.) cable loop (minimum) shall be provided at each end to allow for future movement.

3) The fiber optic backbone shall use a conventional hierarchical “star” design where each TC is wired to the primary hub (main cross-connect system) or a secondary hub (intermediate cross-connect system) and then to the primary hub. There shall be no more than two hierarchical levels of cross-connects in the backbone wiring. Each primary hub shall be connected and terminated to a CCS in the Telephone Switch Room. Additionally, a parallel separate fiber optic interconnection shall be provided between the Telephone Switch Room CCS and the MDF in the Main Computer Room.
4) In the TC’s, Telephone Switch Room, and Main Computer Room, all fiber optic cables shall be installed in a CCS and/or MDF rack mounted fiber optic cable distribution component/splice case (Contractor provided and installed rack), patch, or breakout panel in accordance with industry standards. Female "ST" connectors shall be provided and installed on the appropriate panel for termination of each strand.
5) The Contractor shall test each fiber optic strand. Cable transmission performance specifications shall be in accordance with EIA/TIA standards. Attenuation shall be measured in accordance with EIA fiber optic test procedures EIA/TIA-455-46, -61, or -53 and NFPA. Information transmission capacity shall be measured in accordance with EIA/TIA-455-51 or -30 and NFPA. The written results shall be provided to the COTR for review and approval.

3. Specific Subsystem Requirements: The System shall consist, as a minimum, of the following independent sub-systems to comprise a complete and functional voice and digital telecommunications cabling system: “Main” (MTC), “intermediate” (IMTC), and “riser” (RTC) TC’s; “backbone” cabling (BC) system; “vertical” (or “riser”) trunk cabling system; “horizontal” (or “lateral”) sub-trunk cabling system, vertical and horizontal cross-connection (VCC and HCC respectively) cabling systems, and TCO’s with a minimum of three (3)

RJ-45 jacks for the appropriate telephone, Data connections, and additional jacks, connectors, drop and patch cords, terminators, and adapters provided.

a. Telecommunication Closet (TC):

1) There shall be a minimum of one TC for the MTC, each building IMTC, and each RTC per building floor location. However, in large building(s), where the horizontal distance to the farthest voice and digital work area may exceed 90 Meters (M) (or 295 feet [ft]), additional TC’s shall be provided as described herein. The maximum DC resistance per cable pair shall be no more than 28.6 Ohms per 305 M (1,000 feet). Each TC shall be centrally located to cover the maximum amount of local floor space. The TC’s house in cabinets or enclosures, on relay racks, and/or on backboards, various telecommunication data equipment, controllers, multiplexers, bridges, routers, LAN hub(s), telephone cross-connecting, active and passive equipment.

2) Additionally, the TC’s may house fire alarm, nurses call, code one (or blue), video, public address, radio entertainment, intercom, and radio paging equipment. Regardless of the method of installation, mounting, termination, or cross-connecting used, all backbone, vertical, and horizontal copper and fiber optic cables shall be terminated on appropriate cross-connection systems (CCS) containing patch panel(s), punch blocks, and/or breakout devices provided in enclosures and tested as described herein. A cable and/or wire management system shall be a part of each CCS.

a) A minimum of three 110-120 VAC active quad outlets shall be provided, each with “U” grounded receptacles at a minimum of one outlet for each front, side and back wall. These outlets shall be separately protected by an AC circuit breaker provided in the designated Government Emergency Critical Care AC power panel, that is connected to the Facilities Emergency AC Power Distribution System. For larger building TC applications, a minimum of one additional quad AC outlet shall be provided for every 800M²

(or 8,000 ft²) of useable floor space. Additional outlets shall be equally spaced along the wall.

b) Climate control shall be provided in each TC 24 hours a day, seven days per week and 52 week per year to prevent failure of electronic components and for mission critical functional applications. The COTR and/or Facility Chief Engineering Officer are responsible for informing the Contractor regarding the minimum climate control requirements. In identified hostile TC locations where it has been determined (by the COTR or Facility Chief Engineer) that proper TC climate or external signal radiation cannot be properly maintained or controlled, the Contractor may, at his/her option, provide a minimum of two individual and properly sized self contained climate controlled equipment cabinet enclosures; one designated for voice, and one designated for data service, in each TC location identified on the drawings, in lieu of providing additional required TC air handling capability.

b. Cross-connect Systems (CCS):

1) The CCS shall be selected based on the following criteria: requires the use of a single tool, has the fewest amount of parts, and requires the least amount of assembly or projected trouble shooting time during the life of the system.

2) The CCS system used at the MTC, each IMTC, and each TC shall force cross-connect cable slack management through adherence to the OEM’s installation methods, provided cable management systems, and as described herein, so that moves, adds, and changes can be administered easily and cost effectively.

3) Copper Cables: The MTC, each IMTC, and TC shall contain a copper CCS sized to support the System TCO’s and connections served by each individual TC and as shown on the drawings. The System layout shall allow for a minimum of 50% anticipated growth. Additionally, each CCS must provide maximum flexibility, while maintaining performance, in order to meet system-changing requirements that are likely to occur throughout its useful life.

4) Fiber Optic Cables:
   a) The MTC and each TC shall contain a fiber CCS sized to support the System TCO's and connections served by each individual TC and as shown on the drawings. The System layout shall allow for a minimum of 50% anticipated growth.
   b) Each fiber CCS must provide maximum flexibility and cable management while maintaining performance in order to meet changing requirements that are likely to occur throughout the expected life of the system. All fiber optic cable slack shall be stored in protective enclosures.
   c) If it is determined that a fiber optic distribution system is not necessary for the immediate system needs. Each TC shall be provided with fiber optic cable(s) that contain a minimum of 12 strands "dark" multimode fiber and 12 strands "dark" single mode fiber, each fiber properly terminated on its respective female stainless steel connector mounted in an appropriate fiber termination enclosure provided in each TC.
5) The Contractor shall not "cross-connect" the copper or fiber optic cabling systems and subsystems even though appropriate "patch" cords are to be provided for each "patch", "punch", or "breakout" panel. In addition, the Contractor shall not provide active electronic distribution or interface equipment as a part of the System.
6) Grounding: Proper grounding and bonding shall be provided for each TC and all internal equipment. Reference shall be made to proper codes and standards, such that all grounding systems must comply with all applicable National, Regional, and Local Building and Electrical codes. The most stringent code of these governing bodies shall apply.
   a) If local grounding codes do not exist for the System location, then at a minimum, a #6 American Wire Gauge (AWG) stranded copper wire, or equivalent copper braid, shall be connected to a separate earth grounding system for each TC (the looping of TC's in a general location is allowed as long as the specifications contained herein are met). Under no circumstance shall the AC neutral be used for this

ground. See PART 3 – EXECUTION for specific grounding instructions.

b) Each copper UTP or STP cable that enters a TC from the outside of a building (regardless if the cable is installed underground or aerial) shall be provided with a surge protector and grounded an to earth ground at each cable's entry point in and out of the MTC and each IMTC.

c. Main Cross-connection Subsystem (MCCS): The MCCS shall be located in the MTC and it shall be the common point of appearance for inter and intra-building copper and fiber optic "backbone" system cables, and connections to the telephone and data cable systems. The MTC usually houses telephone EPBX, public address, radio paging interface, routers, and main hierarchical data LAN concentrating equipment. Additionally, it shall provide a single administration and management point for the entire System.

d. Voice (or Telephone) Cable Cross-Connection Subsystem:

1) Due to the usually high number of copper cable termination's required at the MCCS, Insulation Displacement Connection (IDC) hardware shall be used. Termination options shall include the following for a Category 6 Cabling System: IDC termination of cross-connection wire(s), IDC patch cord connector to IDC patch cord connector, and hybrid modular cord to IDC patch cord connector shall be the minimum provided.

2) Additionally, due to the large or many MCCS (at initial installation and over the life of the System) copper termination points, the CCS that makes the best use of real estate while still following the OEM design and installation guidelines, and meeting the specifications described herein, shall be provided.

3) For ease of maintenance purposes, all terminations shall be accessible without the need for disassembly of the IDC wafer. IDC wafers shall be removable from their mounts to facilitate testing on either side of the connector. Designation strips or labels shall be removable to allow for inspection of the terminations. The maximum number of terminations on a wall or on a rack frame or panel shall comply with the OEM recommendations and guidelines, and as described herein. A

cable management system shall be provided as a part of the IDC.

4) IDC connectors shall be capable of supporting cable re-terminations without damaging the connector and shall support a minimum of 200 (telephone equipment standard compliant) IDC insertions or withdrawals on either side of the connector panel.
5) A non-impact termination method using a full-cycle terminating tool having both a tactile and an audible feedback to indicate proper termination is required. For personnel safety and ease of use in day to day administration, high impact installation tools shall not be used.
6) All system “inputs” from the EPBX, FTS, Local Telephone System, or diverse routed voice distribution systems shall appear on the “left” side of the IDC (110A blocks with RJ45 connections are acceptable alternates to the IDC) of the MCCS.
7) All system “outputs” from the MCCS to the voice backbone cable distribution system shall appear on the “right” side of the same IDC (or 110A blocks) of the MCCS.
8) The splitting of pairs within cables between different jacks or connections shall not be allowed. In the case of ISDN and/or ATM and /or Frame Relay applications, terminating resistors shall be provided externally to the patch panel connector or jack.
9) UTP or STP cross connecting wires shall be provided for each “pair” of connection terminals plus an additional 50% spare.

e. Data Cross-Connection Subsystems:

1) The MCCS shall be a Main Distribution Terminating (MDT) data unit and shall be provided in the MTC. The MDT shall consist of a “patch” panel(s) provided with modular RJ45 female connectors for cross-connection of all copper data cable terminations. The panels shall provide for system grounding (where no dielectric cables are used) and be provided with a cable management system.
2) Each panel shall conform to EIA dimensions and be suitable for mounting in standard equipment racks, have the RJ45 jacks aligned in two horizontal rows (up to a maximum of 48 jacks

per panel), and shall not exceed the OEM's recommendations. Each RJ45 jack shall be of modular design and capable of accepting and functioning with other modular (i.e. RJ11) plugs without damaging the jack. It is not necessary to provide a jack for unused positions that are not part of the 50% expansion requirement.

a) All data system inputs from the server(s), data LAN, bridge, or interface distribution systems shall appear on the "top" row of jacks of the appropriate patch panel.

b) All System outputs or backbone cable connections shall appear on the "bottom" row of jacks of the same patch panel.

c) The splitting of pairs within cables between different jacks shall not be allowed. In the case of ISDN and/or ATM and/or Frame Relay applications, terminating resistors shall be provided externally to the patch panel connector or jack.

3) A patch cord shall be provided for each system "pair" of connection jacks. Each patch cord shall have modular RJ45 connectors provided on each end to match the panel's modular RJ45 female jack's being provided.

f. Fiber optic Cross-Connection Subsystems: The MTC shall be provided with a separate fiber MCCS. Each TC shall be provided with a rack mounted patch or distribution panel that is installed inside a lockable cabinet or "breakout enclosure" that accommodates a minimum of 12 strands multimode fiber and 12 strand single mode fiber (these counts shall not be included the 50% spare requirement). Two of the single mode fibers shall be designated for educational analog video applications. A cable management system shall be provided for each panel.

1) The panel(s) shall contain a minimum of 24 female "ST" connectors, be able to accommodate splices and field mountable connectors and have capacity for additional connectors to be added up to the OEM's maximum standard panel size for this type of use. All patch panel sides, including the front and back, shall be protected by a cabinet or enclosure.

2) The panel(s) shall conform to EIA dimensions and be suitable for installation in standard racks, cabinets, and enclosures. The panels shall provide for system grounding (where no dielectric cables are used).
3) The patch panel with the highest OEM approved density of fiber “ST” termination’s (maximum of 72 each), while maintaining a high level of manageability, shall be selected. Patch cables, with proper “ST” connectors installed on each end shall be provided for each pair of fiber optic cable “ST” connectors.
   a) All System “inputs” from interface equipment or distribution systems shall appear on the “top” row of connectors of the appropriate patch panel.
   b) All System “outputs” or backbone cable connections shall appear on the “bottom” row of connectors of the same patch panel.
4) In order to achieve a high level of reliability that approximates that of an OEM connector, field installable connectors shall have an OEM specified physical contact polish. Every fiber cable shall be terminated with the appropriate connector, and tested to ensure compliance to OEM and specifications outlines herein. Where a local fiber optic system connector standard, Industry Standard fiber optic “ST” female connector terminated with a fiber optic cable, shall be used. But, if the fiber optic cable is not used (or “dark”), a “ST” male terminating “cap” shall be provided for each unused “ST” female connector.

g. Intermediate Cross-connection Subsystems (IMCCS): The MTC and each IMTC shall be provided with an IMCCS that shall be the connection point between the MCCS system and the distribution backbone cable and the IMCCS, that is located in one or more buildings on a campus, where each IMCCS is placed by system design. For a technical explanation of internal equipment and system requirements, refer to the above MTC and MCCS paragraphs.
h. Distribution Cable Systems / Backbone Cable System (Common to Inter-buildings): The backbone cable system extends from the MCCS to each IMCCS to establish service between buildings on a campus. The media (copper and fiber optic) used in the BC system shall be

designed according to the system requirements, OEM standards and guidelines, and as described herein. A multi-pair copper for voice and data, and separate multiple fiber optic backbone system shall be provided as a part of the BC distribution system.

1) All outside cable shall be minimum of STP or UTP, 22 AWG solid conductors, solid PVC insulation, and filled core (flexgel - waterproof Rural Electric Association (REA) LISTED PE 39 CODE) between the outer armor or jacket and inner conductors protective lining.
2) The copper cable system shall be configured as a “Star” Topology with separate dedicated cables between the MCCS and each IMCCS.
3) UTP and STP copper cables shall consist of thermoplastic insulated conductors formed into binder groups. The groups are to be identified by distinctly colored binders and assembled to form a single compact core covered by a protective sheath. Each cable shall be rated for Category 6 Telecommunications System Service. A minimum of eight pairs per circuit, plus an additional 50% spare for growth shall be provided.
4) Where the distance limitations of UTP or STP may be exceeded, multimode (or single mode) fiber optic cable(s) shall be used to augment the voice and/or data backbone cable system(s). The total loss of each fiber shall not exceed 12 decibel (dB) at 850 nano-Meter (nM), 11 dB at 1,300 nM, or 10 dB at 1,500 nM.
5) All voice system “inputs” from the MCCS via the BC distribution system shall appear on the “left” side of IDC (minimum 110 blocks) punch terminals of the IMCCS.
6) All voice system “outputs” or trunk line connections shall appear on the “right” side of the same IDC (minimum 110 blocks) of the IMCCS.
7) All data system “inputs” from the MCCS via the BC distribution system shall appear on the “top” row of jacks of the appropriate patch panel of the IMCCS.
8) All data system “outputs” or trunk line connections shall appear on the “bottom” row of jacks in the same patch panel of the IMCCS.

9) The splitting of pairs within cables between different jacks shall not be allowed. In the case of ISDN and/or ATM and /or Frame Relay applications, terminating resistors shall be provided externally to the patch panel connector or jack.

10) A patch cord shall be provided for each system “pair” of connection jacks. Each patch cord shall have modular connectors provided on each end to match the panel’s modular female jack.

11) The fiber optic BC system shall be configured as a “Buss” Topology with separate dedicated fibers between the MCCS and each IMCCS. The System shall be sized to meet the system requirements plus an expansion capability of 50%. Fiber optic cable(s) having a minimum of 12 strands multimode fiber and 12 strands single mode fiber shall be provided. Two of the single mode fibers shall be designated for analog video service.

12) All BC shall be identified with permanent labels at both ends. Labels will indicate system, floor, closet, and zone. The label designations shall match those used for cross-connect terminals and patch panels.

i. Distribution (Common to Intra-Building) Cabling Systems: The intra-building trunk cabling system provides for connection between the IMCCS and each Riser TC’s provided vertical cross-connecting system (VCCS) within a building. The media (copper and fiber optic) used in the intra-building backbone cabling system shall be designed according to the system requirements, OEM standards and guidelines, and as described herein. A multi-pair copper for voice and data, and separate multiple fiber optic trunk system shall be provided as a part of the System.

1) Category 6 UTP or STP multi-pair trunk cable(s) shall be used in the voice and data trunk-line-cabling systems. A minimum of eight pairs per circuit, plus an additional 50% spare for growth shall be provided.

2) Where the distance limitations of UTP and/or STP will be exceeded, multimode (or single mode) fiber optic cable shall be used in the voice and/or trunk cabling systems. The total loss of the fiber trunks shall not exceed 12 dB at 850 nM , 11 dB at 1,300 nM, or 10 dB at 1,500 nM.

a) All voice system “outputs” from the IMCCS to the trunk-line distribution system shall appear on the “right” side of IDC (minimum 110A blocks) punch terminals of the IMCCS.

b) All data system “outputs” from the IMCCS to the trunk-line distribution system shall appear on the “bottom” row of jacks of the same IDC (minimum 110A blocks) of the IMCCS.

c) The splitting of pairs within cables between different jacks shall not be allowed. In the case of ISDN and/or ATM and/or Frame Relay applications, terminating resistors shall be provided externally to the patch panel connector or jack.

d) A patch cord shall be provided for each system “pair” of connection jacks. Each patch cord shall have modular connectors provided on each end to match the panel’s modular female jack.

3) The fiber optic trunk line system shall be configured as a “Buss” Topology with separate dedicated fibers between the IMCCS and each RCS. The System shall be sized to meet the System requirements with a expansion capability of 50% provided. Separate individual fiber optic cable(s) with a minimum of 18 strands multimode fiber and/or 12 strands single mode fiber shall be provided. Two of the single mode fibers shall be designated for analog video service.

4) All trunk lines shall be identified with permanent labels at both ends. Labels will indicate system, floor, closet, and zone. The label designations shall match those used for cross-connects and patch panels.

a) All System outputs from the IMCCS to the trunk-line distribution system shall appear on the “bottom” row of “ST” connectors in the appropriate patch panel.

b) A patch cord shall be provided for each system “pair” of connection “ST” connectors. As a minimum, each patch cord shall have “ST” male connectors provided on each end to match the panel’s female “ST” connector provided.

j. VCCS and Horizontal Cross-connecting (HCCS) Systems: Each TC shall be provided with a separate VCCS and HCCS located within the TC. The VCCS and HCCS shall interconnect and interface the

riser (vertical) trunk line cables with the horizontal (or station) sub-trunk line cables. The media (copper and fiber optic) used in the CCS system shall be designed according to the System requirements, OEM standards and guidelines, and as described herein. A multi-pair copper for voice and data, and separate multiple fiber optic CCS system shall be provided as a part of the System.

1) The UTP, STP, and fiber optic trunk-line cabling systems are that connected between the trunk-lines and Riser VCCS, shall be terminated:
   a) On the “left” or “top” IDC (or 110A blocks) for each UTP or STP voice cable.
   b) On the “top” row of RJ45 jacks on the appropriate patch panel for each UTP or STP data cable.
   c) On the “top” row of “ST” connectors on the appropriate patch panel for each fiber.
2) The UTP, STP, and fiber optic sub-trunk (lateral) floor distribution cabling systems that are connected between each RTC and each TCO or secondary system distribution or connection point, shall terminate on an appropriate HCCS, at the:
   a) On the “right” IDC (or 110A block) used as the VCCS input for each UTP or STP voice cable.
   b) On the “bottom row of RJ45 jacks on the appropriate patch panel used as the VCCS input for each UTP or STP data cable.
   c) On the “bottom” row of “ST” connectors on the appropriate patch panel used as the VCCS input for each fiber.
   d) The technical requirements of the VCCS and HCCS “patch”, “terminating”, or “breakout” panels and cable management assemblies for voice, data and fiber optic cables shall be as described in the above MCCS, IMCCS, and TC technical paragraphs.
3) The Contractor shall not “cross-connect” the VCCS or HCCS cabling systems even though appropriate patch cords are provided for each “patch”, “punch”, or “breakout” panel. Also,

the Contractor shall not provide active interface or distribution electronic equipment as a part of the System.

k. Horizontal (or Station) Cabling (HC): The HC distribution cabling systems connects the distribution field of the voice and data HCCS, in a “Star” Topology, to each TCO or connector and as shown on the drawings via the sub-trunk system.
   1) Horizontal cables shall consist of insulated, UTP or STP conductors that are rated for Category 6 telecommunications service for voice and data systems.
   2) The number of UTP or STP distribution pairs dedicated to each floor from the HC shall be sufficient to accommodate all the horizontal voice and data circuits served by the distribution cable to each TCO.
      a) A minimum of four pairs for voice shall be connected to the “right” side of the IDC (or 110A block) that the VCCS “input” connections appear in the RTC.
      b) A minimum of two separate sets of four pairs each for data shall be connected to the “bottom” row of RJ45 jacks that the VCCS “input” connections appear in the RTC.
   3) The horizontal cable length to the farthest system outlet shall be limited to a maximum of 90M (or 295 ft). These maximum lengths must be derated, adjusted and reduced to include cross-connection and distribution system losses. Additional TC(s) shall be provided on large floor areas of buildings to limit the horizontal distribution to a maximum of 90M (or 295 ft).
   4) The splitting of pairs within a cable between different jacks shall not be permitted.
   5) The installation of the HC shall conform to appropriate OEM recommendations and standards outlined herein. This requirement will insure adequate protection for Electro-Magnetic Interference (EMI) sources.
   6) A system design where “looping” the HC distribution cables from room to room shall not be permitted.

l. System Telecommunication Outlets (TCO): The System shall be capable of receiving the specified telephone (or voice) and data signals acquired from the LEC, FTS contracted carrier and

computer system, and one each fiber optic single mode and multimode cables and shall process and distribute them to the designated TCO's and as shown on the drawings. At a minimum, one TCO shall be provided on each room wall, associated with an active 120 VAC shall be provided and as shown on the drawings. The only exception to the general rule, of one outlet per wall, shall be those "special" locations (e.g., surgical suites, radiology MRI rooms, labs, patient bed rooms, warehouse, loading docks, storage rooms, etc.) where there is usually only one TCO provided as designated on the drawings.

1) Each TCO shall consist of three multipin modular RJ45 jacks, one designated for telephone and two for data service. Each TCO with appropriate jacks installed shall be provided by the Contractor in each designated location and as shown on the drawings.
2) The Contractor shall connect each telephone multipin modular RJ45 jack to a separate "right side as you look at it" telephone HC distribution system HCCS "punch down" 110A block or approved IDC terminating device in each associated RTC. The modular RJ45 jack shall be able to accept and operate with smaller modular RJ11 plugs while providing proper connection and not damaging the modular jack. he OEM shall warrant all modular RJ45/11 jacks in such a manner to be usable for modular RJ11 plugs.
3) The Contractor shall connect each TCO data multipin modular RJ45 jack to a separate lower row jack on the HCCS "patch panel" in each associated RTC. The Contractor is not to "cross-connect" VCCS and HCCS data distribution cables <u>or</u> provides active electronic data distribution equipment as a part of the System.
4) A non-impact termination method, using either a stuffer cap with installation tool or full-cycle terminating tool having both tactile and audible feedback to indicate proper termination shall be used. High impact installation tools shall not be used.

5) Each terminated conductor end shall be properly trimmed to assure a minimum clearance of 6.35 mm (0.250 in) clearance between the conductors of adjacent modules.
6) The multipin RJ45 jack shall be modular in construction that will accept and operate with a modular UTP and STP RJ45 connector and its pin assignments.
7) The Contractor shall connect each fiber optic TCO “ST” connector to a separate fiber optic “bottom” row “ST” connector HCCS “patch panel” or “breakout” terminating device in each associated TC. The Contractor is not to “interconnect” VCCS and HCCS fiber optic distributions cables or provide active fiber optic electronic distribution equipment as a part of the system.

B. System Performance:
1. At a minimum, the System shall be able to support the following voice and data operations for Category 6 Certified Telecommunication Service:
a. Provide the following interchange (or interface) capabilities:
1) Basic Rate (BRI).
2) Primary Rate (PRI).
b. ISDN measured at:
1) Narrow Band BRI.
a) B Channel: 64 kilo-Bits per second (kBps), minimum.
b) D Channel: 16 kBps, minimum.
c) H Channel: 384 kBps, minimum.
2) Narrow Band PRI:
a) B Channel: 64 kBps, minimum.
b) D Channel: 64 kBps, minimum.
c) H Channel: 1,920 kBps, minimum.
3) Wide (or Broad) Band:
a) All channels: 140 mega(m)-Bps, minimum, capable to 565 mBps at “T” reference.
c. ATM operation and interface: ATM 155 mBps.
d. Frame Relay: All stated compliance’s.
e. Integrated Data Communications Utility (IDCU) operation and interface.

f. Government Open Systems Interconnection Profile (GOSSIP) compliant.

g. Fiberoptic Distributed Data Interface (FDDI): A minimum 100 mBps to a maximum of 1.8 giga(g)-Bps data bit stream speed. (Shall be Synchronous Optical Network [Sonet] compliant).

h. System Sensitivity: Satisfactory service shall be provided for at least 3,000 feet for all voice and data.

2. At a minimum the System shall support the following operating parameters:

a. EPBX connection:

1) System speed: 1.0 gBps per second, minimum.

2) Impedance: 600 Ohms.

3) Cross Modulation: -60 deci-Bel (dB).

4) Hum Modulation: -55 Db.

5) System data error: 10 to the -10 Bps, minimum loss measured at the frame output with reference Zero (0) deciBel measured (dBm) at 1,000 Hertz (Hz) applied to the frame input.

a) Trunk to station: 1.5 dB, maximum.

b) Station to station: 3.0 dB, maximum.

c) Internal switch crosstalk: -60 dB when a signal of ± 10 deciBel measured (dBm), 500-2,500 Hz range is applied to the primary path.

d) Idle channel noise: 25 dBm “C” or 3.0 dBm “O” above reference (terminated) ground noise, whichever is greater.

e) Traffic Grade of Service for Voice and Data:

(1) A minimum grade of service of P-01 with an average traffic load of 7.0 CCS per station per hour and a traffic overload in the data circuits will not interfere with, or degrade, the voice service.

(2) Average CCS per voice station: The average CCS capacity per voice station shall be maintained at 7.0 CCS when the EPBX is expanded up to the projected maximum growth as stated herein.

b. Telecommunications Outlet (TCO):

1) Voice:

a) Isolation (outlet-outlet): 24 dB.

b) Impedance: 600 Ohms, balanced (BAL).

c) Signal Level: 0 deciBel per mili-Volt (dBmV) ± 0.1 dBmV.

d) System speed: 100 mBps, minimum.

e) System data error: 10 to the -6 Bps, minimum.

2) Data:

a) Isolation (outlet-outlet): 24 dB.

b) Impedance: 600 Ohms, BAL.

c) Signal Level: 0 dBmV ± 0.1 dBmV.

d) System speed: 120 mBps, minimum.

e) System data error: 10 to the -8 Bps, minimum.

3) Fiber optic:

a) Isolation (outlet-outlet): 36 dB.

b) Signal Level: 0 dBmV ± 0.1 dBmV.

c) System speed: 540 mBps, minimum.

d) System data error: 10 to the -6 BPS, minimum.

C. General:

1. All equipment to be supplied under this specification shall be new and the current model of a standard product of an OEM or record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
   a. Maintains a stock of replacement parts for the item submitted.
   b. Maintains engineering drawings, specifications, and operating manuals for the items submitted.
   c. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.
2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the System. When the Contractor furnishes an item of equipment for which there is a specification contained herein, the item of equipment shall meet or exceed the specification for that item of equipment.
3. The Contractor shall provide written verification, in writing to the RE at time of installation, that the type of wire/cable being provided is recommended and approved by the OEM. The Contractor is responsible for providing the proper size and type of cable duct

and/or conduit and wiring even though the actual installation may be by another subcontractor.

4. The Telephone Contractor is responsible for providing interfacing cable connections for the telephone, and PA systems with the System.
5. The telephone equipment and PA interface equipment shall be the interface points for connection of the PA interface cabling from the telephone switch via the system telephone interface unit.
6. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone equipment, systems, and service.
7. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.
8. All interconnecting twisted pair and fiber-optic cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps shall be terminated according to the OEM’s instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair wire, fiber-optic cable unterminated, unconnected, loose or unsecured.
9. Color code all distribution wiring to conform to the Telephone Industry standard, EIA/TIA, and this document, which ever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance. Reference Specification Section 27 10 00, STRUCTURED CABLING and Section 27 31 31, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT - EXTENSION.
10. Connect the System’s primary input AC power to the Facility’ Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.
11. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the

System OEM. Base- band cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, and connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.

12. All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cycolac plastic for the areas where provided.
13. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.

D. Equipment Functional Characteristics:

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
POWER LINE FREQUENCY	60 HZ ±2.0 HZ
Operating Temperature	O to 50 degrees (°) Centigrade (C)
Humidity	80 percent (%) minimum rating

E. Equipment Standards and Testing:

1. The System has been defined herein as connected to systems identified as Critical Care performing Life Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
2. All supplies and materials shall be listed, labeled or certified by UL or a nationally recognized testing laboratory where such standards have been established for the supplies, materials or equipment. See paragraph minimum requirements Section 27 05 11,

REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, and the guidelines listed in paragraph 2.J.2.

3. The provided active and passive equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the COTR approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.
4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards.

2.2 DISTRIBUTION EQUIPMENT AND SYSTEMS

A. Telecommunication Outlet (TCO):

1. The TCO shall consist of one telephone multipin jack and two data multipin jacks and jacks mounted in a steel outlet box. A separate 100mm (4in.) x 100mm (4in.) x 63mm (2.5in.) steel outlet box with a labeled stainless steel faceplate will be used. A second 100mm (4in.) x 100mm (4in.) x 63mm (2.5in.) steel outlet box with a labeled faceplate shall be provided as required adjacent to the first box to ensure system connections and expandability requirements are met.
2. All telephone multipin connections shall be RJ-45/11 compatible female types. All data multipin connections shall be RJ-45 female types. All fiber optic (single mode and multimode) connections shall be “ST” stainless steel female types.
3. The TCO shall be fed from the appropriate CCS located in the respective RTC in a manner to provide a uniform and balanced distribution system.
4. Interface of the data multipin jacks to appropriate patch panels (or approved “punch down” blocks) in the associated RTC, is the responsibility of the Contractor. The Contractor shall not extend data cables from the RTCs to data terminal equipment or install data terminal equipment.

5. The wall outlet shall be provided with a stainless steel or approve alternate cover plate to fit the telephone multipin jack, data multi- pin jacks, fiber optic jacks and the outlet box provided (100mm (4in.) x 100mm (4in.) for single and 100mm (4in.) x 200mm (8in.) for dual outlet box applications). For PBPU installations, the cover plate shall be stainless steel.
6. Interface of the fiber optic “ST” jacks to appropriate patch panels in the associated RTC, is the responsibility of the Contractor. The Contractor shall not cross-connect fiber optic cables in the to fiber optic equipment or install fiber optic equipment.

B. Distribution Cables: Each cable shall meet or exceed the following specifications for the specific type of cable. Each cable reel shall be sweep tested and certified by the OEM by tags affixed to each reel. The Contractor shall turn over all sweep tags to the COTR or PM. Additionally, the Contractor shall provide a 610 mm (2 ft.) sample of each provided cable, to the COTR and receive approval before installation. Cables installed in any outside location (i.e. above ground, under ground in conduit, ducts, pathways, etc.) shall be filled with a waterproofing compound between outside jacket (not immediately touching any provided armor) and inter conductors to seal punctures in the jacket and protect the conductors from moisture.

1. Remote Control:
   a. The remote control cable shall be multi-conductor with stranded (solid is permissible) conductors. The cable shall be able to handle the power and voltage necessary to control specified system equipment from a remote location. The cable shall be UL listed and pass the FR-1 vertical flame test, at a minimum. Each conductor shall be color-coded. Combined multi-conductor and coaxial cables are acceptable for this installation, as long as all system performance standards are met.
   b. Technical Characteristics:

Length	As required, in 1K (3,000 ft.) reels minimum
Connectors	As required by system design
Size	18 AWG, minimum, Outside 20 AWG, minimum, Inside

Color coding	Required, EIA industry standard
Bend radius	10X the cable outside diameter
Impedance	As required
Shield coverage	As required by OEM specification
Attenuation	
Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
50.0	52.0

2. Telephone:
   a. The System cable shall be provided by the Contractor to meet the minimum system requirements of Category Six service. The cable shall interconnect each part of the system. The cable shall be completely survivable in areas where it is installed.
   b. Technical Characteristics:

Length	As required, in 1K (3,000 ft.) reels minimum
Cable	Voice grade category six
Connectors	As required by system design
Size	22 AWG, minimum, Outside 24 AWG, minimum, Inside
Color coding	Required, telephone industry standard
Bend radius	10X the cable outside diameter
Impedance	120 Ohms ± 15%, BAL
Shield coverage	As required by OEM specification
Attenuation	
Frequency in mHz	dB per 305 M (1,000ft.), maximum

0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
62.0	52.0
100.0	68.0

3. Data Multi-Conductor:
   a. The cable shall be multi-conductor, shielded or unshielded cable with stranded conductors. The cable shall be able to handle the power and voltage used over the distance required. It shall meet Category Six service at a minimum.
   b. Technical Characteristics:

Wire size	22 AWG, minimum
Working shield	350 V
Bend radius	10X the cable outside diameter
Impedance	100 Ohms ± 15%, BAL
Bandwidth	100 mHz, minimum
DC RESISTANCE	10.0 Ohms/100M, maximum
Shield coverage	
Overall Outside (if OEM specified)	100%
Individual Pairs (if OEM specified)	100%
Attenuation	
Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0

20.0	29.0
25.0	33.0
31.0	36.0
62.0	52.0
100.0	68.0

4. Fiber Optic:
   a. Multimode Fiber:
      1) The general purpose multimode fiber optic cable shall be a dual window type installed in conduit for all system locations. A load-bearing support braid shall surround the inner tube for strength during cable installation.
      2) Technical Characteristics:

Bend radius	6.0", minimum Outer jacket, As required
FIBER DIAMETER	62.5 MICRONS
Cladding	125 microns
Attenuation	
850 nM	4.0 dB per kM, maximum
1,300 nM	2.0 dB per kM, maximum
Bandwidth	
850 nM	160 mHz, minimum
1,300 nM	500 mHz, minimum
Connectors	Stainless steel

   b. Single mode Fiber:
      1) The general purpose single mode fiber optic cable shall be a dual window type installed in conduit for all system locations. A load-bearing support braid shall surround the inner tube for strength during cable installation.
      2) Technical Characteristics:

Bend radius	100 mm (4 in.) minimum
Outer jacket	PVC
Fiber diameter	8.7 microns
Cladding	125 microns
Attenuation at 850 nM	1.0 dBm per km
Connectors	Stainless Steel

5. AC Power Cable: AC power cable(s) shall be 3-conductor, no. 12 AWG minimum, and rated for 13A-125V and 1,625W. Master AC power, installation specification and requirements, are given in the NEC and herein.

C. Outlet Connection Cables:

1. Telephone:

a. The Contractor shall provide a connection cable for each TCO telephone jack in the System with 10% spares. The telephone connection cable shall connect the telephone instrument to the TCO telephone jack. The Contractor shall not provide telephone instrument(s) or equipment.

b. Technical Characteristics:

Length	1.8M (6ft.), minimum
Cable	Voice Grade
Connector	RJ-11/45 compatible male on each end
Size	24 AWG, minimum
Color coding	Required, telephone industry standard

2. Data:

a. The Contractor shall provide a connection cable for each TCO data jack in the system with 10% spares. The data connection cable shall connect a data instrument to the TCO data jack. The Contractor shall not provide data terminal(s)/equipment.

b. Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Data grade Category Six
Connector	RJ-45 male on each end
Color coding	Required, data industry standard
Size	24 AWG, minimum

3. Fiber Optic:
   a. The Contractor shall provide a connection cable for each TCO fiber optic connector in the System with 10% spares. The data connection cable shall connect a fiber optic instrument to the TCO fiber optic jack. The Contractor shall not provide fiber optic instrument(s)/equipment.
   b. Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Flexible single conductor with jacket
Connector	ST male on each end
Size	To fit single mode or multimode cable

D. System Connectors:
   1. Solderless (Forked Connector):
      a. The connector shall have a crimp-on coupling for quick connect/disconnect of wires or cables. The crimp-on connector shall be designed to fit the wire or cable furnished. The connector barrel shall be insulated and color-coded.
      b. Technical Characteristics:

Impedance	As required
Working Voltage	500 V

   2. Multipin:
      a. The connector shall have a crimp-on coupling for quick connect/disconnect of wires or cables. The crimp-on connector

shall be designed to fit the wire or cable furnished. The connector housing shall be fully enclosed and shielded. It shall be secured to the cable group by screw type compression sleeves.

b. Technical Characteristics:

Impedance	As required
Working Voltage	500 V
Number of pins	As requires, usually 25 pairs minimum

3. Modular (RJ-45/11 and RJ-45): The connectors shall be commercial types for voice and high speed data transmission applications. he connector shall be compatible with telephone instruments, computer terminals, and other type devices requiring linking through the modular telecommunications outlet to the System. The connector shall be compatible with UTP and STP cables.

a. Technical Characteristics:

Type	Number of Pins
RJ-11/45	Compatible with RJ45
RJ-45	Eight
Dielectric	Surge
Voltage	1,000V RMS, 60 Hz @ one minute, minimum
Current	2.2A RMS @ 30 Minutes or 7.0A RMS @ 5.0 seconds
Leakage	100 μA, maximum
Connectability	
Initial contact resistance	20 mili-Ohms, maximum
Insulation displacement	10 mili-Ohms, maximum
Interface	Must interface with modular jacks from a variety of OEMs. RJ-11/45 plugs shall provide connection when used in RJ-45 jacks.
Durability	200 insertions/withdrawals, minimum

4. Fiber Optic: The connectors shall be commercial types for voice and high speed data transmission applications. The connector shall be compatible with telephone instruments, computer terminals, and other type devices requiring linking through the modular telecommunications outlet to the system. The connector shall be compatible with UTP and STP cables.

E. Terminators:

1. Coaxial:
   a. These units shall be metal-housed precision types in the frequency ranges selected. They shall be the screw-on type that has low VSWR when installed and the proper impedance to terminate the required system unit or coaxial cable.
   b. Technical Characteristics:

Frequency	0-1 GHz
Power blocking	As required
Return loss	25 dB
Connectors	“F”, "BNC", minimum
Impedance	50 or 75 Ohms, UNBAL

2. Audio:
   a. These units shall be metal-housed precision types in the frequency ranges selected. They shall be the screw-on audio spade lug, twin plug, XL types that has low VSWR when installed and the proper impedance to terminate the required system unit or coaxial cable.
   b. Technical Characteristics:

Frequency	20-20 kHz, minimum
Power blocking	As required
Return loss	15 dB
Connectors	"Audio spade lug", “1/4”, “1/8”, "XL" or "RCA"
Impedance	
Bal	100 Ohms, minimum

Unbal	75 Ohm, minimum

3. Fiber Optic:
   a. These units shall be metal-housed precision types in the frequency ranges selected. They shall be the screw-on type that has low VSWR when installed and the proper impedance to terminate the required system unit or fiber optic cable.
   b. Technical Characteristics:

Frequency	Lightwave
Power blocking	As required
Return loss	25 dB
Connectors	"ST", minimum
Construction	Stainless steel
Impedance	As required

F. Distribution Frames:
1. A new stand-alone (i.e., self supporting, free standing) MDF shall be provided to interconnect the EPBX and computer room. The MDF shall be modular and equipped with modular terminating mini blocks (i.e. Ericsson, 3M, etc.), and patch panels that are as small as possible and provide all the requirements of this specifications as described herein.
2. All cable distribution closets and MDFs shall be wired in accordance with industry standards and shall employ "latest state-of-the-art" modular cross-connect devices. The MDF/telephone closet riser cable shall be sized to satisfy all voice requirements plus not less than 50% spare (growth) capacity in each telephone closet which includes a fiber optic backbone. The MDF/telephone closet riser cable shall be sized to satisfy all voice and data requirements plus not less than 50% spare (growth) capacity in each telephone closet which does not include a fiber optic backbone.
3. The MDF and all intermediate distribution frames shall be connected to the EPBX system ground.
4. Technical Characteristics:

Telephone	
IDC type unit	As described in Part 2
Contact wires	50 micron of Gold over Nickel
Contact pressure	100 Grams, MIN
110A Punch blocks	Acceptable alternate to IDC
Data	110A blocks as described in Part 2
Fiber optic	Patch panel as described in Part 2
Analog Video	Patch panel as described in Part 2

2.3 TELECOMMUNCATIONS CLOSET REQUIREMENTS

Refer to VA Handbook H-088C3, Telephone System Requirements, for specific TC guidelines for size, power input, security, and backboard mounting requirements. It is the Contractors responsibility to ensure TC compliance with the System Requirements.

2.4 ENVIRONMENTAL REQUIREMENTS

Technical submittals shall identify the environmental specifications for housing the system. These environmental specifications shall identify the requirements for initial and expanded system configurations for:

A. Floor loading for batteries and cabinets.
B. Minimum floor space and ceiling heights.
C. Minimum size of doors for equipment passage.
D. Power requirements: The bidders shall provide the specific voltage, amperage, phases, and quantities of circuits required.
E. Air conditioning, heating, and humidity requirements. The bidder shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.
F. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).
G. Proposed floor plan based on the expanded system configuration of the bidder's proposed EPBX for this Facility.
H. Conduit size requirement (between equipment room and console room).

2.5 INSTALLATION KIT

The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:

A. System Grounding:
   1. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.
   2. This includes, but is not limited to:
      a. Coaxial Cable Shields.
      b. Control Cable Shields.
      c. Data Cable Shields.
      d. Equipment Racks.
      e. Equipment Cabinets.
      f. Conduits.
      g. Duct.
      h. Cable Trays.
      i. Power Panels.
      j. Connector Panels.
      k. Grounding Blocks.
B. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
C. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.

D. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.

E. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.

F. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.

G. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Product Delivery, Storage and Handling:

1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The COTR may inventory the cable, patch panels, and related equipment.
2. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the COTR.

B. System Installation:

1. After the contract’s been awarded, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the System without written approval from the COTR and PM.
2. The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a

manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.

3. The Contractor shall install suitable filters, traps, directional couplers, splitters, TC’s, and pads for minimizing interference and for balancing the System. Items used for balancing and minimizing interference shall be able to pass telephone and data signals in the frequency bands selected, in the direction specified, with low loss, and high isolation, and with minimal delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements of Paragraph 2.1.C and the System performance standards.
4. All passive equipment shall be connected according to the OEM's specifications to insure future correct termination, isolation, impedance match, and signal level balance at each telephone/data outlet.
5. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
6. All lines shall be terminated in a suitable manner to facilitate future expansion of the System. There shall be a minimum of one spare 25 pair cable at each distribution point on each floor.
7. All vertical and horizontal copper and fiber optic cables shall be terminated so any future changes only requires modifications of the existing EPBX or signal closet equipment only.
8. Terminating resistors or devices shall be used to terminate all unused branches, outlets, equipment ports of the System, and shall be devices designed for the purpose of terminating fiber optic or twisted pair cables carrying telephone and data signals in telephone and data systems.
9. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.
10. Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two keys.

C. Conduit and Signal Ducts:

1. Conduit:
   a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes,

connectors, sleeves, weatherheads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed. The minimum conduit size shall be 19 mm (3/4 in.).

b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow telephone cables to be installed in partitioned cable tray with data cables may be granted in writing by the COTR if requested.) Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.

c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

d. When ”innerduct” flexible cable protective systems is specifically authorized to be provided for use in the System, it’s installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

e. Conduit (including GFE) fill shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.

f. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

g. Ensure that Critical Care Nurse Call, and PA Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.

2. Signal Duct, Cable Duct, or Cable Tray:
   a. The Contractor shall use existing signal duct, cable duct, and/or cable tray, when identified and approved by the COTR.
   b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
   c. Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The COTR shall approve width and height dimensions.

D. Distribution System Signal Wires and Cables:
   1. Wires and cables shall be provided in the same manner and use like construction practices as Fire Protective and other Emergency Systems that are identified and outlined in NFPA 101, Life Safety Code, Chapters 7, 12, and/or 13, NFPA 70, National Electrical Code, Chapter 7, Special Conditions. The wires and cables shall be able to withstand adverse environmental conditions in their respective location without deterioration. Wires and cables shall enter each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.
      a. Each wire and cable shall terminate on an item of equipment by direct connection. Spare or unused wire and cable shall be provided with appropriate connectors (female types) that are installed in appropriate punch blocks, barrier strips, patch, or bulkhead connector panels.
      b. Fiber optic cables that are spare, unused or dark shall be provided with Industry Standard “ST” type female connectors installed in appropriate break out, patch, or bulkhead connector panels provided in enclosure(s) and shall be protected from the environment.

c. Coaxial cables that are spare, unused or dark shall be provided with the cable OEM specified type female connectors installed in appropriate break out, patch, or bulkhead connector panels provided in enclosure(s) and shall be protected from the environment.

d. All cable junctions and taps shall be accessible. Provide an 8″ X 8″ X 4″ (minimum) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible.

2. Routing and Interconnection:

a. Wires or cables between consoles, cabinets, racks and other equipment shall be in an approved conduit, signal duct, cable duct, or cable tray that is secured to building structure.

b. Wires and cables shall be insulated to prevent contact with signal or current carrying conductors. Wires or cables used in assembling consoles, panels, equipment cabinets and racks shall be formed into harnesses that are bundled and tied. Harnessed wires or cables shall be combed straight, formed and dressed in either a vertical or horizontal relationship to equipment, controls, components or terminations.

c. Harnesses with intertwined members are not acceptable. Each wire or cable that breaks out from a harness for connection or termination shall have been tied off at that harness or bundle point, and be provided with a neatly formed service loop.

d. Wires and cables shall be grouped according to service (i.e.: AC, grounds, signal, DC, control, etc.). DC, control and signal cables may be included with any group. Wires and cables shall be neatly formed and shall not change position in the group throughout the conduit run. Wires and cables in approved signal duct, conduit, cable ducts, or cable trays shall be neatly formed, bundled, tied off in 600 mm to 900 mm (24 in. to 36 in.) lengths and shall not change position in the group throughout the run. Concealed splices are not allowed.

e. Separate, organize, bundle, and route wires or cables to restrict EMI, channel crosstalk, or feedback oscillation inside any enclosure. Looking at any enclosure from the rear (wall mounted enclosures, junction, pull or interface boxes from the front),

locate AC power, DC and speaker wires or cables on the left; coaxial, control, microphone and line level audio and data wires or cables, on the right. This installation shall be accomplished with ties and/or fasteners that will not damage or distort the wires or cables. Limit spacing between tied off points to a maximum of 150 mm (6 inches).

f. Do not pull wire or cable through any box, fitting or enclosure where change of cable tray or signal or cable duct alignment or direction occurs. Ensure the proper bend radius is maintained for each wire or cable as specified by it's OEM.

g. Employ temporary guides, sheaves, rollers, and other necessary items to protect the wire or cable from excess tension or damage from bending during installation. Abrasion to wire or cable jackets is not acceptable and will not be allowed. Replace all cables whose jacket has been abraded. The discovery of any abraded and/or damaged cables during the proof of performance test shall be grounds for declaring the entire system unacceptable and the termination of the proof of performance test. Completely cover edges of wire or cable passing through holes in chassis, cabinets or racks, enclosures, pull or junction boxes, conduit, etc., with plastic or nylon grommeting.

h. Cable runs shall be splice free between conduit junction and interface boxes and equipment locations.

i. Cables shall be installed and fastened without causing sharp bends or rubbing of the cables against sharp edges. Cables shall be fastened with hardware that will not damage or distort them.

j. Cables shall be labeled with permanent markers at the terminals of the electronic and passive equipment and at each junction point in the System. The lettering on the cables shall correspond with the lettering on the record diagrams.

k. Completely test all of the cables after installation and replace any defective cables.

l. Wires or cables that are installed outside of buildings shall be in conduit, secured to solid building structures. If specifically approved, on a case by case basis, to be run outside of conduit, the wires or cables shall be installed, as described herein. The bundled wires or cables must: Be tied at not less than 460 mm (18

in.) intervals to a solid building structure; have ultra violet protection and be totally waterproof (including all connections). The laying of wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not allowed and will not be approved.

m. Wires or cables installed outside of conduit, cable trays, wireways, cable duct, etc.

1) Only when specifically authorized as described herein, will wires or cables be identified and approved to be installed outside of conduit. The wire or cable runs shall be UL rated plenum and OEM certified for use in air plenums.

2) Wires and cables shall be hidden, protected, fastened and tied at 600 mm (24 in.) intervals, maximum, as described herein to building structure.

3) Closer wire or cable fastening intervals may be required to prevents sagging, maintain clearance above suspended ceilings, remove unsightly wiring and cabling from view and discourage tampering and vandalism. Wire or cable runs, not provided in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers shall be sleeved and sealed with an approved fire retardant sealant.

4) Wire or cable runs to system components installed in walls (i.e.: volume attenuators, circuit controllers, signal, or data outlets, etc.) may, when specifically authorized by the RE, be fished through hollow spaces in walls and shall be certified for use in air plenum areas.

n. Wires or cables installed in underground conduit, duct, etc.

1) Wires or cables installed in underground installations shall be waterproofed by the inclusion of a water protective barrier (i.e. gel, magma, etc.) or flooding compound between the outside jacket and first shield. Each underground connection shall be accessible in a manhole, recessed ground level junction box, above ground pedestal, etc., and shall be provided with appropriate waterproof connectors to match the cable being installed. Once the System has been tested and found to meet the System performance standards and accepted by VA, the Contractor shall provide waterproof shrink tubing or

approved mastic to fully encompass each wire or cable connection and overlay at least 150 mm (6 inches) above each wire or cable jacket trim point.

2) It is not acceptable to connect waterproofed cable directly to an inside CCS punch block or directly to an equipment connection port. When an under ground cable enters a building, it shall be routed directly to the closest TC that has been designated as the building's IMTC. The Contractor shall provide a "transition" splice in this TC where the "water proofed" cable enters on one side and "dry" cable exits on the other side. The "transition" splice shall be fully waterproof and be capable of reentry for system servicing. Additionally, the transition splice shall not allow the waterproofing compound to migrate from the water proof cable to the dry cable.

3) Warning tape shall be continuously placed 300 mm (12 inches) above buried conduit, cable, etc.

E. Outlet Boxes, Back Boxes, and Faceplates:

1. Outlet Boxes: Signal, power, interface, connection, distribution, and junction boxes shall be provided as required by the system design, on-site inspection, and review of the contract drawings.
2. Back Boxes: Back boxes shall be provided as directed by the OEM as required by the approved system design, on-site inspection, and review of the contract drawings.
3. Face Plates (or Cover Plates): Faceplates shall be of a standard type, stainless steel, anodized aluminum or UL approved cycolac plastic construction and provided by the Contractor for each identified system outlet location. Connectors and jacks appearing on the faceplate shall be clearly and permanently marked.

F. Connectors: Circuits, transmission lines, and signal extensions shall have continuity, correct connection and polarity. A uniform polarity shall be maintained between all points in the system.

1. Wires:
   a. Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable.

b. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current. Punch blocks are approved for signal, not AC wires. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.

2. Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include; but, are not limited to: Audio spade lug, punch block, wirewrap, etc.
3. Line or Microphone Audio: Each connector shall be installed according to the cable or connector OEM's instructions and use the OEM's approved installation tool. Install the connector's to provide and maintain the following audio signal polarity:
   a. XLR type connectors Signal or positive conductor is pin 3; common or neutral conductor is pin 2; ground conductor is pin 1.
   b. Two and 3 conductor 1/4" Signal or positive conductor is tip; neutral or 1/8" phono plugs conductor is ring and ground or shield and jacks conductor is sleeve.
   c. RCA Phono Plugs the Signal or positive conductor is tip; and Jacks neutral or shield conductor is sleeve.
4. Speaker Line Audio:
   a. Each connector shall be installed according to the cable, transformer or speaker OEM instructions and using the OEM's approved installation tool. The Contractor shall ensure each speaker is properly phased and connected in the same manner throughout the System using two conductor type wires.
   b. One of the conductors shall be color coded to aid in establishing speaker signal polarity. Each speaker line shall be permanently soldered or audio spade lug connected to each appropriate speaker or line matching transformer connection terminal. Speaker line connection to each audio amplifier shall use audio spade lugs, as described herein.

G. AC Power: AC power wiring shall be run separately from signal cable.

H. Grounding:

1. General: The Contractor shall ground all Contractor Installed Equipment and identified Government Furnished Equipment to eliminate all shock hazards and to minimize, to the maximum extent possible, all ground loops, common mode returns, noise pickup, crosstalk, etc. The total ground resistance shall be 0.1 Ohm or less.
   a. The Contractor shall install lightning arrestors and grounding in accordance with the NFPA and this specification.
   b. Under no conditions shall the AC neutral, either in a power panel or in a receptacle outlet, be used for system control, subcarrier or audio reference ground.
   c. The use of conduit, signal duct or cable trays as system or electrical ground is not acceptable and will not be permitted. These items may be used only for the dissipation of internally generated static charges (not to be confused with externally generated lightning) that may applied or generated outside the mechanical and/or physical confines of the System to earth ground. The discovery of improper system grounding shall be grounds to declare the System unacceptable and the termination of all system acceptance testing.
2. Cabinet Buss: A common ground buss of at least #10 AWG solid copper wire shall extend throughout each equipment cabinet and be connected to the system ground. Provide a separate isolated ground connection from each equipment cabinet ground buss to the system ground. Do not tie equipment ground busses together.
3. Equipment: Equipment shall be bonded to the cabinet bus with copper braid equivalent to at least #12 AWG. Self grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternates.
4. Cable Shields: Cable shields shall be bonded to the cabinet ground buss with #12 AWG minimum stranded copper wire at only one end of the cable run. Cable shields shall be insulated from each other, faceplates, equipment racks, consoles, enclosures or cabinets; except, at the system common ground point. Coaxial and audio cables, shall have one ground connection at the source; in all cases, cable shield ground connections shall be kept to a minimum.

I. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A. All lettering for voice and data circuits shall be stenciled using laser printers or thermal ink transfer process. Handwritten labels are not acceptable.

1. Cable and Wires (Hereinafter referred to as “Cable”): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System “Record Wiring Diagrams”.
2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
4. Termination Hardware: The Contractor shall label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the “Record Wiring Diagrams”.

3.2 TESTS

A. Interim Inspection:

1. This inspection shall verify that the equipment provided adheres to the installation requirements of this document. The interim inspection will be conducted by a factory-certified representative and witnessed by a Government Representative. Each item of installed equipment shall be checked to insure appropriate UL certification markings. This inspection shall verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568B pin assignments and cabling connections are in compliance with ANSI/EIA/TIA standards. Visually confirm Category 5e marking of outlets, faceplates, outlet/connectors and patch cords.
2. Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

3. The Contractor shall notify the COTR, in writing, of the estimated date the Contractor expects to be ready for the interim inspection, at least (20) working days before the requested inspection date.
4. Results of the interim inspection shall be provided to the COTR and PM. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the system installation.
5. The COTR and/or the PM shall determine if an additional inspection is required, or if the Contractor will be allowed to proceed with the installation. In either case, re-inspection of the deficiencies noted during the interim inspection(s), will be part of the proof of performance test. The interim inspection shall not affect the Systems' completion date. The Contracting Officer shall ensure all test documents will become a part of the Systems record documentation.

B. Pretesting:

1. Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.
2. Pretesting Procedure:
   a. During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.
   b. The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. The Contractor shall measure and record the aural carrier levels of each system telephone and data channel, at each of the following points in the system:
      1) Local Telephone Company Interfaces or Inputs.
      2) EPBX interfaces or inputs and outputs.
      3) MDF interfaces or inputs and outputs.
      4) EPBX output S/NR for each telephone and data channel.

5) Signal Level at each interface point to the distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.

3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the COTR.

C. Acceptance Test: After the System has been pretested and the Contractor has submitted the pretest results and certification to the COTR, then the Contractor shall schedule an acceptance test date and give the COTR (30) days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total System meets the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

D. Verification Tests:

1. Test the UTP, STP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test the operation of shorting bars in connection blocks. Test cables after termination and prior to cross-connection.
2. Multimode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-B.3 and ANSI/EIA/TIA-526-14A using Method A, Optical Power Meter and Light Source and/or Method B, OTDR. Perform verification acceptance test.
3. Single mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-B.3 and ANSI/EIA/TIA-526-7 using Method A, Optical Power Meter and Light Source and/or Method B, OTDR. Perform verification acceptance test.

E. Performance Testing:

1. Perform Category 5e tests in accordance with ANSI/EIA/TIA-568-B.1 and ANSI/EIA/TIA-568-B.2. Test shall include the following: wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.

2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with ANSI/EIA/TIA-568-B.3.

F. Total System Acceptance Test: The Contractor shall perform verification tests for UTP, STP copper cabling system(s) and the multimode and single mode fiber optic cabling system(s) after the complete telecommunication distribution system and workstation outlet are installed.

1. Voice Testing: Connect to the network interface device at the demarcation point. Go off-hook and receive dial tone from the LEC. If a test number is available, place and receive a local, long distance, and FTS telephone call.
2. Data Testing: Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network is achieved.

3.3 TRAINING

A. Furnish the services of a factory-trained engineer or technician for a total of two four hour classes to instruct designated Facility IRM personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.

B. Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the COTR and Chief of Engineering Service.

3.4 GUARANTEE PERIOD OF SERVICE

A. Contractor’s Responsibilities:

1. The Contractor shall guarantee that all installed material and equipment will be free from defects, workmanship, and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM’s equipment warranty documents, to the COTR, that certifies each item of equipment installed conforms to OEM published specifications.
2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. The Contractor and OEM shall provide this contact capability at no additional cost to the VA.

3. All Contractor installation, maintenance, and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the one year guarantee period:
   a. Response Time:
      1) The facility COTR is the Contractor’s reporting and contact officials for the System trouble calls, during the guarantee period.
      2) A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.
      3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
         a) A routine trouble call within one working days of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
         b) An emergency trouble call within (6) hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at anytime. Additionally, the loss of a minimum of (50) station or system lines shall be deemed as this type of a trouble call.
      4) The Contractor shall respond on-site to a catastrophic trouble call within (4) hours of its report. A catastrophic trouble call is considered total system failure.
         a) If a system failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate system CSS or TCO equipment, or cables. The alternate equipment and/or cables shall be operational within four hours after the four hour trouble shooting time.
         b) Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as a catastrophic trouble call if so determined by the COTR. The COTR shall

notify the Contractor of this type of trouble call at the direction of the Facilities Director.

b. Required on-site visits during the one year guarantee period

1) The Contractor shall visit, on-site, for a minimum of eight hours, once every 12 weeks, during the guarantee period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this SPEC.

a) The Contractor shall arrange all Facility visits with the COTR prior to performing the required maintenance visits.

b) The Contractor in accordance with the OEM’s recommended practice and service intervals shall perform preventive maintenance during a non-busy time agreed to by the COTR and the Contractor.

c) The preventive maintenance schedule, functions and reports shall be provided to and approved by the COTR.

2) The Contractor shall provide the COTR a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the COTR with sample copies of these reports for review and approval at the beginning of the Total System Acceptance Test. The following reports are the minimum required:

a) Monthly Report: The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to COTR by the fifth working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and Systems for preventive and predictive maintenance

b) Contractor Log: The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation

and specific recommendations to avoid such conditions in the future.

3) The COTR shall provide the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
   a) The COTR shall ensure copies of these reports are entered into the System's official acquisition documents.
   b) The Facilities Chief Engineer shall ensure copies of these reports are entered into the System's official technical as-installed documents.

B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use, accidents, other vendor, contractor, owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the COTR in writing upon the discovery of these incidents. The COTR will investigate all reported incidents and render findings concerning any Contractor's responsibility.

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SECTION 27 31 31
VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT - EXTENSION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating extension of an existing operating Telephone System, and associated equipment (here-in-after referred to as “the System”) and associated equipment to be installed in the VA Medical Center here-in-after referred to as “the Facility”. The System shall include, but not be limited to, equipment cabinets, interface enclosures, and relay racks, stand-by battery(s), necessary combiners, traps, and filters; distribution nodes and/or amplifiers; telephone instruments; auxiliary systems; and necessary passive devices such as: protectors, isolators, splitters, couplers, cable “patch”, “punch down”, and cross-connector blocks or devices, cable management items, voice and digital cable distribution system, and associated hardware. The System shall additionally include, but not be limited to: telecommunication closets (TC); telecommunications outlets (TCO); copper and fiber optic distribution cables, connectors, “patch” cables, and/or “break out” devices.

B. The System shall be delivered free of engineering, manufacturing, installation, and operating defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.

C. The term “provide”, as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.

D. The Telephone System is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Therefore, if the System connects to or extends the telephone system, the System’s installation and operation shall adhere to all appropriate National, Government, and/or Local Life Safety and/or Support Codes, which ever are the more stringent for this Facility. At a minimum, the System shall be installed according to NFPA, Section 70, National Electrical Code (NEC), Article 517 and Chapter 7; NFPA, Section 99, Health Care Facilities, Chapter 3-4; NFPA, Section 101, Life Safety Code, Chapters 7, 12, and/or 13; Joint Commission on

Accreditation of Health Care Organization (JCAHCO), Manual for Health Care Facilities, all necessary Life Safety and/or Support guidelines; this specification; and the original equipment manufacturer's (OEM) suggested installation design, recommendations, and instructions. The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of this specification before the System is designed, engineered, delivered, and provided.

E. The VA Project Manager (PM) and/or if delegated, Contracting Officer Technical Representative (COTR) are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the COTR before proceeding with the change.

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
C. Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
D. Section 26 27 26, WIRING DEVICES.
E. Section 26 41 00, FACILITY LIGHTNING PROTECTION.
F. Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
G. H-088C3: VA HANDBOOK DESIGN FOR TELEPHONE SYSTEMS

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date the system’s submittal is technically approved by VA, shall be enforced.
B. Joint Commission on Accreditation of Health Care Organization (JCAHO): Comprehensive Accreditation Manual for Hospitals - Volumes One and Two.
C. National and/or Government Life Safety Code(s):The more stringent of each listed code.
D. National Fire Protection Association (NFPA):

No. 70	National Electrical Code (NEC)
No. 75	Protection of Electronic Computer/Data Processing Systems
No. 77	Recommended Practice on Static Electricity
No. 99	Standard for Health Care Facilities
No. 101	Life Safety Code
No. 1221	Emergency Services Communication Systems

E. Underwriter's Laboratories, Inc. (UL):

65	Wired Cabinets
96	Lightning Protection Components
96A	Installation Requirements for Lightning Protection Systems
467	Grounding and Bonding Equipment
497/497A/497B	Protectors for Paired Conductors/ Communications Circuits/Data Communications and Fire Alarm Circuits
884	Underfloor Raceways and Fittings

F. ANSI/EIA/TIA PUBLICATIONS:

568B	Commercial Building Telecommunications
569B	COMMERCIAL BUILDING STANDARD FOR TELECOMMUNICATIONS PATHWAYS AND SPACES
598C	Optical Fiber Cable Color Coding
606A	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
607A	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
758	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings

G. Lucent Technologies: Document 900-200-318 "Outside Plant Engineering Handbook".

H. International Telecommunication Union – Telecommunication Standardization Sector (ITU-T).

I. Federal Information Processing Standards (FIPS) Publications.

J. Federal Communications Commission (FCC) Publication: Standards for telephone equipment and systems.

K. United States Air Force: Technical Order 33K-l-lOO - Test Measurement and Diagnostic Equipment (TMDE) Interval Reference Guide.

1.4 QUALITY ASSURANCE

A. The authorized representative of the System's OEM shall be responsible for the design, satisfactory total operation of the System, and its certification.

B. The OEM shall meet the minimum requirements identified in Paragraph 2.1.A. Additionally, the Contractor shall have had experience with three or more installations of systems of comparable size and complexity with regard to coordinating, engineering, testing, certifying, supervising, training, and documentation. Each of these installations shall have been in successful operation for a minimum of three years after final acceptance by the user. These installations shall be provided as a part of the submittal identified in Paragraph 1.5.

C. The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment. In addition, the OEM and System Contractor shall accept complete responsibility for the design installation, certification, and physical support for the System. This documentation, along with the System Contractor and OEM certifications must be provided in writing as a part of the Contractor's Technical Submittal.

D. The Contractor's Telecommunications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the COTR before being allowed to commence work on the System.

1.5 SUBMITTALS

A. On-Site Survey: The Contractor shall provide an on-site telephone equipment location, cable pathway, TC, TCO, and interconnection survey

with the submittal that is accomplished no later than 18 months prior to the expected completion of the facility.

1. The survey will be accomplished by a physical walk through of the facility and existing locations with the contract drawings (including all approved changes) and existing survey performed by the IRM department. Differences in locations between the two surveys shall be clearly identified and shall be provided to the COTR in writing within (30) days of the completion of the survey.

B. Provide submittals in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. The COTR shall retain one copy for review and approval.

1. If the submittal is approved the COTR shall retain one copy for Official Records and return three (3) copies to the Contractor.
2. If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached indicating the areas where the submittal deviated from the System Specifications. The COTR shall retain one copy for Official Records.

C. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:

1. Title page to include:
   a. VA Medical Center.
   b. Contractor’s name, address, and telephone (including fax) numbers.
   c. Date of Submittal.
   d. VA Project No.
2. List containing a minimum of three (3) locations of installations of similar size and complexity as identified herein. These locations shall contain the following:
   a. Installation Location and Name.
   b. Owner’s or user’s name, address, and telephone numbers (including fax).
   c. Date of Project Start and Date of Final Acceptance by Owner.
   d. System Project Number.
   e. Brief (three paragraphs minimum) description of each system’s function, operation, and installation.
3. Narrative: Description of the System as it is expected to be installed.

4. A list of equipment to be furnished. The quantity, make and mode number of each item is required. Select the required equipment items quantities that will satisfy the needs of the System. Delete equipment items that are not required, add additional items required, and renumber section as per system design. List format shall be as follows:

The following is the minimum equipment required by the System:

QUANTITY	UNIT
As required	CSU
As required	Back-up Battery Power Supply
As required	AC Power Supply
As required	Equipment Cabinet(s)
As required	Environmental Cabinet
As required	Distribution/Interface Cabinets
As required	Stand Alone Relay Rack
As required	CCS
As required	Audio Alarm Panel
As required	Trouble Annunciator Panel
As required	Wire Management System/Equipment
As required	Telephone Instruments
As required	Cable Distribution System
As required	System Conduits, Cable Duct, and/or Cable Tray
1 ea.	Installation Kit
1 ea.	Separate Spare Part List
As required	Telephone Paging Adapter (one each required for PA, Radio Paging and sub-systems)
As required	Time Out Device (one each required for PA, Radio, and Dial Dictation sub-system)

5. Interface cabinet and each distribution cabinet layout drawing, as each is to be installed.
6. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
7. Engineering drawings of the System, showing calculated signal levels at the CSU output, each input and output distribution point,

proposed telephone outlet values, and signal level at each telephone outlet multipin jack.

8. List of test equipment as per paragraph 1.5.E below.
9. A letter certifying that the Contractor understands the requirements of the Samples paragraph 1.5.F below.
10. A letter certifying that the Contractor understands the requirements of Section 3.2 concerning acceptance tests.

D. Environmental Requirements: Technical submittals shall confirm the environmental specifications for TC areas occupied by the System. These environmental specifications shall identify the requirements for initial and expanded system configurations for:

1. Floor loading for batteries and cabinets.
2. Minimum floor space and ceiling heights.
3. Minimum size of doors for equipment passage.
4. Power requirements: The bidders shall provide the specific voltage, amperage, phases, and quantities of circuits required.
5. Air conditioning, heating, and humidity requirements. The Contractor shall identify the ambient temperature and relative humidity operating ranges required to prevent equipment damage.
6. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).
7. Main backbone, trunk line, riser, and horizontal cable pathways, cable duct, and conduit requirements between each MTC, TC, and TCO.

E. Test Equipment List. The Contractor is responsible for furnishing all test equipment required to test the System in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of an accuracy better than the parameters to be tested. The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 3 months prior to the test. As part of the proposal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:

1. Spectrum Analyzer.
2. Signal Level Meter.
3. Volt-Ohm Meter.

4. Time Domain Reflectomoter (TDR) with strip chart recorder.
5. Bit Error Test Set (BERT).

F. Samples. A sample of each of the following items shall be furnished to the COTR for approval prior to installation. The samples may be returned to the Contractor at the discretion of the COTR.
1. TCO Wall Outlet Box 100 mm x 100 mm x 63 mm (4" x 4"x 2.5") with:
   a. One each telephone (or voice) RJ45 jack installed.
   b. Two each multi pin data RJ45 jacks installed.
   c. Cover Plate installed.
2. Data CCS patch panel, punch block or connection device with RJ 45 connectors installed.
3. Telephone CCS system with IDC and/or RJ45 connectors and cable terminal equipment installed.
4. Fiber optic CCS patch panel or breakout box with cable management equipment and “ST” connectors installed.
5. 610 mm (2 ft.) section of each copper cable to be used with cable sweep tags as specified in Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING, and connectors installed.
6. 610 mm (2 ft.) section of each fiber optic cable to be used with cable sweep tags as specified in Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING, and connectors installed.

G. Certifications:
1. Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.
2. Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Local (whichever is the more stringent) Life Safety Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.
3. Preacceptance Certification: This certification shall be made in accordance with the test procedure paragraph 3.2.B.

H. Equipment Manuals: Ten (10) working days prior to the scheduled acceptance test, the Contractor shall deliver four (4) complete sets of commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the COTR. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams and parts list.

I. As-Installed Equipment and Wiring Diagrams. Fifteen (15) working days prior to the scheduled acceptance test, the Contractor shall deliver four complete sets of the Record Wiring Diagrams of the System to the COTR. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, equipment and room/area locations. The drawings shall show the signal levels of the telephone aural carriers of each telephone channel at the input and output of all electronic equipment, beginning and end of each distribution line, and the telephone outlets. The record wiring diagrams shall be provided in hard copy and two compact disk copies properly formatted to match the Facilities current operating version of Computer Aided Drafting (AUTO CAD) system. The COTR shall verify and inform the Contractor of the current version of AutoCAD being used by the Facility. The COTR shall submit one hard copy of each as-installed drawing to TSSO-005N2 for review (15) working days prior to the scheduled acceptance test.

J. Ten (10) days prior to the start of the intermediate test, provide a typewritten detailed description of the System testing plan that meets this specification’s performance standards as indicated in paragraph 2.1.C including illustrations and utilizes test equipment specified in paragraph 1.5.C. The test plan will need to be evaluated and approved by the COTR before intermediate testing begins.

K. Provide two copies of an OEM developed training video tape presentation (reference paragraph 3.3.B) for evaluation and approval by the COTR.

L. Provide a typewritten document that details the complete record program in memory for all associated station assignments.

M. Needs Analysis (required for extension of existing system): The Contractor shall conduct a needs analysis of the existing Facility with representative’s from the IRM and various departments to determine the System’s requirements. The analysis shall depict System features and capacities, in addition to specific site requirements. The analysis

shall be typewritten and contain the following information as a minimum:

1. The CSU shall be compatible with the existing or projected EPBX and will:
   a. Initially provide:

EQUIPPED ITEM	CAPACITY	WIRED CAPACITY
Main Station Lines:		
a) Single Line	As Required	As Required
b) Multi Line (Equipped for DID)	As Required	As Required
Two-way DRTL	As Required	As Required
Foreign Exchange (FX)	As Required	As Required
WATS	As Required	As Required
Conference	As Required	As Required
Dial Dictation Access	As Required	As Required
RADIO PAGING ACCESS	As Required	As Required
AUDIO PAGING ACCESS	As Required	As Required
Off-Premise Extensions	As Required	As Required
CO Trunk By-Pass	As Required	As Required
CO Trunk By-Pass	As Required	As Required

CRT w/keyboard	As Required	As Required
Printers	As Required	As Required
Operator Consoles	As Required	As Required
T-1 Access Equipment	As Required	As Required
Maintenance Console	As Required	As Required

b. Projected Maximum Growth. The Contractor shall identify the projected maximum growth for each item identified in Paragraph 1.5.C.4. as a part of the needs analysis. For this purpose, the following definitions are provided to detail the System’s capability:

1) All software and hardware required to completely equip the CSU with all items listed under equipped capacity, shall be provided and installed by the Contractor (30) days prior to system cut-over.
2) “Wired Capacity" is to include all wiring and equipment listed under wired capacity, with the exception of line, data, and trunk cards, and shall be provided, installed, and tested 30 days prior to system cut-over.
3) The System shall be capable of expansion to the projected maximum growth through the use of printed circuit boards and/or modular cabinets which do not require extensive re-wiring and reprogramming.

2. Cable Distribution System: A design plan for twisted pair distribution cable plant requirements is not included in this document. See Specification Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING, for specific cable distribution system requirements. However, the Contractor is required to formulate a projected cable count that shall coincide with the Maximum Growth items described herein. It is the Contractors responsibility to

provide the systems CCS, cable distribution, and TCO requirements in order to develop a copper distribution requirements plan using the following paragraphs as an example:

a. Twisted Pair Requirements/Column Explanation:

Column	Explanation
From Building	Identifies the building by number or title
Floor	IDENTIFIES THE FLOOR BY NUMBER (I.E. 1ST, 2ND, ETC.)
Room Number	Identifies the room, by number, from which cabling shall be installed
Number of Cable Pair	Identifies the number of cable pair required to be terminated on the floor designated or the number of cable pair (VA Owned) to be retained
Building	Identifies the building by number or title
Room	Identifies room number

b. Fiber Optic Cabling Requirements/Column Explanation:

Column	Explanation
From Building	Identifies building, by number or location, from which cabling is installed
Room Number	Identifies the room, by number, from which cabling shall be installed
To Building	IDENTIFIES BUILDING, BY NUMBER OR LOCATION, TO WHICH CABLING IS INSTALLED
Room Number	Identifies the room, by number, to which cabling shall be installed
Number of Strands	Identifies the number of strands in each run of fiber optic cable
Installed Method	Identifies the method of installation in accordance with requirements as designated herein
Notes	Identifies a note number for a special feature or equipment
Building	Identifies the building by number or title

3. Telephone Instruments (or Stations). The Contractor shall clearly and fully indicate this category for each telephone instrument and compare the total count to the locations identified above and indicated the projected EPBX port count requirements as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares:

Column	Explanation
MSL	Number of Main Station Lines (MSL) to be associated with the instrument.
Instrument and Outlets. All equipment to be installed are assigned the following codes:	
DS	Desk type - single line
WS	Wall type - single line
DM	Desk type - multi-line
WM	Wall type - multi-line
Jack	The type of jack shall be the type identified (i.e. wall, single, dual, triplex, etc.).
Notes	Identifies a note number which spells out a requirement for a special feature or function associated with the circuits and equipment on that particular line of the station.
SVC	Identifies the using SERVICE.
Position	Identifies primary user of the instrument by position description or function.

4. Telecommunication Outlets (TCO). The Contractor shall clearly and fully indicate this category for each outlet location and compare the total count to the locations identified and as shown on the drawings as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. System Requirements:

1. The System shall extend the following minimum services generated by the existing telephone system. If these services are not generated by an operating existing telephone system, the System shall be fully

compatible and capable of providing them in accordance with and supported by an Original Equipment Manufacturer (OEM), and as specified herein. The System shall provide continuous inter and/or intra-Facility service. The System shall be capacity sized so that loss of connectivity to an external telephone system(s) shall not affect the Facilities operation in specific designated emergency operating locations and instruments. The System shall:

a. Inter-operate, connect, and function fully with the existing Local Telephone Exchange (LEC) Network(s), Federal Telephone System (FTS) Inter-city Network(s), Inter-exchange Carriers, Integrated Services Digital Network (ISDN), at a minimum.
b. Inter operate with current identified voice mail and automatic attendant functions, and are required as specified herein. A universal night answering function from a Facility designated remote locations shall be provided if not currently in operation and/or will not be deviated as a result of the system installation.
c. Be a voice and data cable distribution system that is based on a physical “Star” Topology.
d. Be compatible with and able to provide direct digital connection to trunk level equipment including, but, not limited to: directly accessing trunk level equipment including radio paging, audio paging, Federal Information Processing Standards [FIPPS] publications), Industry Standard “T” and/or “DS” carrier protocols and external protocol converters. Additionally, connections to “T” and/or “DS” access/equipment or Customer Service Units (CSU) that are used in FTS and other trunk applications, shall be included in the System design. Additionally T-1 access/equipment (or CSU) shall be used in FTS and other trunk applications as required by system design if these functions are not provided by the existing telephone system and/or will be deactivated by the System. The Contractor shall provide all T-1 equipment necessary to terminate and make operational the quantity of circuits designated. The CSU's shall be connected to the system’s emergency battery power supply. The System shall be fully capable of operating in the Industry Standard “DS” protocol and provide that service when required.

e. Contain attendant and operator consoles, video monitors with keyboards, and printers to provide employee directory access from the Traffic Management System (TMS), as required by system design if not provided by the existing telephone system and/or will be deactivated by the System installation. All additional console positions, video monitors, and keyboards shall have identical capabilities. The System shall accept a mixture of trunk types at each attendant console and extend calls received via these trunks to station users.

f. Be capable of interfacing and operating with Direct-Incoming-dial (DID) service to stations as identified herein. Assignment to DID shall not affect intra-Facility operation. A DID trunk group, which will operate as a separate trunk group from other Central Office (CO) trunks shall be provided as described herein.

g. Contain the designated number of telephone instruments, where each instrument (also referred to as “station”) shall have the ability to direct dial other Facility telephone stations, the public telephone network, tie-lines, and FTS telephone numbers without attendant assistance. Each station shall be dual tone multi-frequency (DTMF) for intra-Facility and external-Facility calling. The term DTMF, as used herein, shall be defined as “a dialing operation (e.g., push-button, digit dialing, or tone dialing, other than rotary/pulse dialing).

   1) Standard digital telephone instruments shall be provided at the designated TCO(s) and as shown on the drawings.

   2) "Special hands free" digital telephone instruments shall be provided at designated TCO(s) and as shown on the drawings.

h. Receive the specified telephone signals acquired from the LEC and FTS contracted carrier, shall process and distribute them to the designated telephone stations as determined by Class-of-Service and indicated on the drawings.

i. At a minimum, one TCO(s) shall be provided on each room wall and on either side of each door opening, and shall be supplied with an associated (within 305 mm (one foot)) or attached active duplex 120 Volts Alternating Current (VAC) outlet (using a quad receptacle box for the TCO and a separate duplex receptacle box for the AC outlet) and as shown on the drawings (The only

exception to this general one outlet per wall rule are specifically identified “special” locations (e.g., surgical suites, radiology, MRI rooms, labs, patient rooms, warehouse, loading docks, storage rooms, etc.) where usually only two active TCOs are designated and as shown on the drawings).

1) The Contractor shall provide the TCOs that consist of one telephone multipin and two data multipin jacks each meeting Category 5 Level of service. The telephone multipin jack shall be interfaced and connected to the System via a terminal punch block in each associated TC.
2) The telephone system Contractor shall connect each data multipin jack to a separate data system approved terminating patch panel device in each associated TC. The telephone system Contractor is not to install active data distribution equipment to the System or cross connect the data systems.
3) The construction of distribution TCOs is found in Specification Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
4) The appropriate distribution cable termination methods are found in Specification Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.
5) The appropriate distribution TC construction is found in Specification Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.

j. Be able to accomplish adjacent channel operation of the existing telephone system’s local, long distance, and FTS telephone signals. The System equipment shall be installed and interfaced according to the OEM's schematic diagram for adjacent telephone channel operation. The System shall be provided with testing capability in each equipment rack and test ports that provides access for each telephone channel without the need to disconnect distribution cables or equipment. Each telephone channel shall be processed as a single channel. A means of monitoring the complete system along with appropriate printout and computer disk archiving of each processed and distributed channel.

k. The System shall be designed to minimize cross talk, background processor noise, inter-modulation, and other signal interference.

The equipment shall be installed and interfaced according to the OEM schematic diagram for adjacent audio channel operation. Each audio input channel shall be processed as a single separate channel and combined into one output channel. Additionally, if not provided in the existing telephone system or will be deactivated by the System installation, an audio, and visual monitoring panel shall be provided in the telephone switch room to test each converted audio input and distribution channel transmitted and received signal functions as described herein. The System shall continuously electronically or electrically supervise the EPBX's Alternating Current (AC) power input, stand by batteries and charger, and internal Direct Current (DC) power supply primary Voltages and/or Currents; each remote control unit, audio interface unit, from the telephone switch room. A trouble panel shall be provided in the telephone switch room to check the supervisory signals, signal level, audio sound and visual level, and alert personnel to problems as described herein.

2. Refer to Section 1.5 for initial voice sizing requirements.
3. The System shall be capable of interfacing with the existing or future planned EPBX.
4. A system design where "looping" the distribution cables from room to room shall not be permitted. See Specification Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING, for cable distribution TC and TCO requirements.
5. The following system channels shall be provided:
   a. Telephone Channels: to match Building Standard.
6. Point of Telephone System Interface:
   a. The telephone signals shall be acquired at the existing telephone EPBX equipment cabinet or as designated in the telephone switch room TC. The Contractor is not responsible for the condition of the telephone signals of the existing telephone system. If the telephone signals at the interface point do not meet the minimum signal level and quality as stated herein, the Contractor shall notify the COTR, in writing, detailing the nature of the deficiencies, and the expected effect on the telephone signals in the new extension system. The COTR will coordinate with the

Facility Engineering Officer so the necessary repairs for the identified deficiencies can be accomplished.

b. The System shall acquire telephone signals at the local ADP closet and as shown on the drawings.

B. General:

1. All equipment to be supplied under this specification shall be new and the current model of a standard product of an OEM of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
   a. Maintains a factory production line for the item submitted.
   b. Maintains a stock of replacement parts for the item submitted.
   c. Maintains engineering drawings, specifications, and operating manuals for the items submitted.
   d. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least one year prior to the Invitation for Bid.
2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the System. When the Contractor furnishes an item for which there is a specification contained herein, the item shall meet or exceed the specification for that item of equipment.
3. The Contractor shall produce verification, in writing to the COTR at time of installation, that the type of wire/cable actually being provided is recommended and approved by the OEM and will provide a total system free of undesirable effects. The Contractor is responsible for providing the correct protection cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.
4. The Telephone Contractor is responsible for interfacing the telephone, PA system with the System. The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method, requires not only a physical and mechanical connection; but, includes matching of signal, voltage, and processing levels, with regard to signal

quality and impedance. Each interface point must adhere to all standards described herein for full separation of the Critical Care, Life Safety, and Emergency systems.

5. The telephone equipment and PA interface equipment shall be the interface points for connection of the PA interface cabling from the telephone switch via the System telephone interface unit. The telephone interface unit and PA interface unit shall be provided by the Telephone Contractor.
6. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the FCC standards for telephone equipment, systems, and service.
7. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.
8. All interconnecting twisted pair, cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps shall be terminated according to the OEM’s instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair wire, cable unterminated, unconnected, loose or unsecured.
9. The System shall utilize microprocessor components for all signaling and programming circuits and functions. Program memory shall be non-volatile or protected from erasure from power outages for a minimum of two hours.
10. The System shall provide the continuous electrical supervision of each telephone switch cabinet mounted equipment, interconnecting cabling, distribution cable plant, and back up battery and charger to determine change of status and to assist in trouble shooting System faults.
11. All distribution Voltages, except for the primary AC power to the power supply circuits, shall not exceed 30V AC Root Mean Squared (RMS) or 42V direct current (DC).
12. Color code all distribution wiring to conform to the Telephone Industry standard, ANSI/EIA/TIA, and this document, which ever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record

wiring diagrams, to facilitate installation and maintenance. Reference Specification Section 27 10 00, STRUCTURED CABLING and Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.

13. Connect the System's primary input AC power to the Facility' Critical Branch of the Emergency AC Power Distribution System as shown on the Drawings or if not shown on the drawings consult with the COTR regarding a suitable circuit location, prior to bidding.
14. Verify existing UPS system will support the extensions additional load. If adequate capacity is not present, provide the additional equipment required to support the normal operation and functions of the System including the extension (as if there was no AC power failure) in the event of an AC power failure for a minimum of four hours.
15. All equipment shall function and operate normally from the furnished power source, and also, during input power fluctuations or loss of power for a minimum of four hours.
16. Plug-in connectors shall be provided to connect all equipment, with the exception of interface points. Baseband cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.
17. All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cycolac plastic that matches the equipment item where it is installed. All faceplates shall be constructed of the same material throughout the Facility.
18. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low voltage circuits.

C. Equipment Functional Characteristics:

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
Power Line Frequency	60 Hz ±2.0 Hz
Operating Temperature	O to 50 degrees (°) Centigrade (C)
Humidity	80 percent (%) minimum rating

2.2 EQUIPMENT SPECIFICATIONS

A. Customer Service Unit (CSU) Equipment:

1. The CSU shall be fully self contained, electronic, digital in operation, fully compatible with the existing telephone equipment, EPBX, and perform, as a minimum, the following functions:
   a. Intra-Facility: station-to-station four digit direct dialing, including those telephone instruments equipped with the DID features.
   b. Direct-output-dial (DOD): from any unrestricted telephone instrument to any CO trunk or FTS access lines by dialing a pre-designated access code. Also, DOD from any station to tie-lines by dialing a pre-designated access code.
   c. Incoming calls from FTS: access lines and tie-lines shall have the ability to direct dial all stations without attendant assistance.
   d. Restricted telephone instruments: shall have access to outside lines through the operators’ console.
   e. Unrestricted telephone instruments: shall have access to all features, functions, CO trunks, FTS access lines, tie-lines, toll free 800 numbers, and long distance directory assistance.
   f. Class-of-service (COS): restrictions provided by the existing telephone system shall be provided. These restrictions are to be applied individually or in combination as dictated by individual telephone number service requirements. Technical submittals shall describe the number and type of COS restrictions available.
   g. Provide all station users with the feature package provided by the existing telephone system or at a minimum, those listed

below. The ability to restrict any of these features on a station by station basis shall be provided:

1) Line Hunt Capability
2) Consultation Hold
3) Shall Transfer
4) Call Pick-Up
5) Call Forwarding
6) Call Queuing
7) Call back/Ring back
8) Music on Hold
9) Conferencing
10) Automatic Number Identification
11) Station to Station Call Waiting
12) Station and System Speed Dialing
13) Call Park
14) Universal Night Answer Service
15) Line Load Control
16) Dual Common Controls
17) Line Lock Out
18) Supervisory Signaling and Ringing

h. Fusing:

1) The CSU shall be equipped with fuses to protect the total telephone system and individual segments of the CSU so that a problem in one segment may be isolated without damaging the total CSU.
2) Fuses shall be of the alarm indicating type and their rating designated by numerical or color code on fuse panels that are easily visible.

i. Equipment Power Supply:

1) The CSU shall be equipped with a complete on-line power supply. The System shall consist of AC surge protection, dual load-sharing rectifiers/chargers, batteries, and inverter.
2) The power supply shall have a capacity sufficient to support the CSU including it’s projected maximum growth and as required in this specification for interfaced equipment.
3) The UPS w/Battery Back-up or the reserve battery power supply shall have sufficient capacity to supply the CSU for four (4)

hours including projected maximum growth and interfaced equipment. The battery power supply shall consist of not less than 24 sealed (dry cells are not acceptable), maintenance-free cells.

4) The system shall be capable of adjustable voltage for float or equalizing batteries. A full redundant system (not including batteries and inverter) shall be provided. Each rectifier or charger shall have the capacity to support the combined load requirements of the existing EPBX as configured including maximum growth and interfaced equipment.

5) The Contractor shall coordinate with the local Facility Telephone Contractor, coordinated through the COTR, to determine CO trunk, FTS access line, and other required interface unit power requirements and provide power to the GFE telephone company or Facility furnished and installed interface units so they will continue to function in event of a commercial AC power failure.

j. Alarms and Trouble Indicators:

1) The Contractor shall provide visual and audible alarms, equipped with cut-off switches, indicating AC power failure, rectifier failure, major and minor alarms, and temperature/humidity alarms. The Contractor shall be responsible for providing the required sensors for environmental alarms. These alarms shall be remoted to the existing telephone system and one other location to be as specified herein. These alarms shall be separate and in addition to the major and minor alarm functions.

2) The alarm panel(s) shall contain small red indicator lamps for each alarm with cut-off switches or one switch for all alarms and a distinctive audible alarm(s) that can be heard over the ambient noise in its respective location. If one cutoff switch is provided for all audible alarms, it shall restore the alarms to the ready status condition for the audible registration of additional alarms.

a) The technical submittal shall describe any other CSU alarms that are remoted.

b) The technical submittal shall describe CSU alarms/indicators of malfunction(s) that are located on the equipment.

k. The CSU shall provide four-digit intra-station dialing.

1) Due to the varied trunk group requirements and possible future trunk group requirements, e.g. audio paging, alternate access codes may be proposed. Grouping of like type trunk group/features, e.g. 5-2 radio paging, 5-3 audio paging is acceptable.

2) The CSU shall provide emergency numbers accessible by all station users. The numbers shall appear on the console or a multi-line instrument and at least one other designated location. There shall be a distinctive audible and visual signal associated with the emergency number to ensure immediate response to calls. The console or multi-line instrument shall have the capability of priority answering the emergency number and extending the call as the situation dictates. A modified trunk circuit may be used for this purpose.

l. The CSU equipment shall have such sensitivity as required to provide satisfactory service up to 3,000 feet for all voice locations.

m. The Contractor shall provide a complete set of EPBX electronic modules and/or cards to be used as on-hand operational emergency spare equipment. One each of T-1, DS-**, interface cards etc. is the minimum required or a compliment as directed by the OEM. Additionally, the Contractor shall confer with the COTR to determine other spare items that may be required to equip the system with a fully emergency repair capability completely adhering to the System Guaranty Requirements as described herein.

2. The installed CSU shall be as a minimum, compatible with the existing EBPX or equipped with the following features at a minimum:

a. AC to DC power supplies.

b. Emergency battery power supply.

c. DC to AC inverter power supply (shall be connected to the CSU emergency battery power supply).

d. Dual common controls.

e. Redundant signaling supply units, or equivalent.
f. Cable distribution frame.
g. Cable distribution system.
h. Programmable Emergency Telephone Number(s).
i. An on-site automatic program loading device (tape drives are not acceptable) to reload system memory in case of power or system failure (shall be connected to the CSU emergency battery power supply).
j. An on-site maintenance administration terminal (MAT) with CRT/keyboard and printer (shall be connected to the CSU emergency battery power supply).
k. An automatic central office trunk connection to pre-determined stations for emergency trunk by-pass/cut-through service. Immediately upon failure of the GFE EPBX, these stations shall have the ability to process calls. If required, each of these stations shall be equipped with automatic ground start for outgoing calls. Single line instruments, if required, shall be provided by the Contractor.

3. Voice Mail:
   a. The system shall allow a predetermined number of users to send complete and confidential messages in the users own voice and receive complete and confidential messages in the sender’s own voice. The system shall provide 24 hours per day, 7 days per week access. The system shall be integrated into the operation of the existing telephone system and be compatible with the local telephone company central office.
   b. The system shall provide capacity for the following number of ports:

	Equipped Capacity	Wired Capacity
Automated Attendant	12	20
Voice Mail	12	20

   c. The voice mail system shall initially provide for 500 mailboxes and 40 hours of storage with growth to 60 hours of storage.

d. Voice Mail Features. The system shall have the following features:

1) Access to the system and its features from any instrument anywhere that provides DTMF signaling.
2) The ability of those leaving a message to review the message and/or edit the message that is being placed in the mailbox.
3) Privacy/Security through the use of a "password".
4) The ability to send messages to users on the voice mail system in the following manner:
   a) To any user on the same voice mail system.
   b) To more than one user on the same voice mail system - an ad hoc distribution list determined by the sender at the time of message transmission.
   c) To a predetermined distribution list.
   d) Broadcast to all users on the same voice mail system.
5) Verification, with Receipt: The ability of a user to request and receive verification of when a message is actually played through the use of a touch-tone command. The system shall indicate the time and date of when a message is played and place that information in the sender's mailbox.
6) Envelope Information: The ability of a user to request and receive time and date information of when specific messages were left in the user's mailbox.
7) Connection to the voice mail system shall be through an extension number of the existing telephone system EPBX or a seven/ten digit telephone number from the LEC.
8) Message "PROMPTS" shall be provided for every transaction. Messages shall be provided for "GREETINGS" and "INSTRUCTIONS FOR RECORDING OR EDITING A MESSAGE".
9) A message waiting tone, lamp, and/or display shall notify the user that messages are in the user's mailbox.
10) A message shall notify the user, upon accessing the system, of how many messages are in the user mailbox.
11) The user, upon accessing the system, shall have the following response alternatives:
   a) Respond or send a reply to another user on the same voice mail system.

b) Route the message to another user on the same voice mail system.

c) Delete the message.

d) Save the message.

12) A "Default Path" shall be provided to allow those callers who do not have touch-tone capability or who need to talk to someone to be routed to an operator or some other predetermined answering position.

13) The system shall the ability to fast forward or rewind-recorded messages while being reviewed by the user.

14) The system shall present messages to the user on a "FIFO" basis.

15) User Administration: The system shall provide, as a minimum, management information and statistics in the following categories:

16) Port Usage: Traffic statistics on each of the different access paths into the system.

17) Usage of Storage Capacity - Remaining storage capacity at any one time and during peak periods.

18) Mailbox Usage: Connect time and number of new or saved messages.

19) The user administration terminal shall allow for "Class of Service Controls" in the following areas and for the following parameters:

a) Initial Authorization:

(1) Ability to enable a mailbox.

(2) Record the "OWNER'S" name.

(3) Set initial PASS NUMBER.

b) Usage Control:

(1) Length of personal greeting.

(2) Length of messages received.

(3) Number of messages.

(4) Message retention time.

c) Feature Authorizations - Allowed or Not:

(1) Group List Creation.

(2) Group List Usage.

(3) Broadcast Messages.

B. Voice Traffic Management System (TMS):

1. A complete and self-contained on-site TMS shall be provided that is fully compatible with and compliments the existing telephone system.
2. As a minimum, the following functions shall be provided:
   a. A 300 characters per second (CPS) letter quality printer, shall be provided. The CSU and/or the maintenance administration terminal may generate some of the reports.
   b. The TMS shall be connected to the CSU emergency battery power supply.
   c. All screen menus shall be standard with access to each category of reports to be provided.
   d. Traffic Accounting and Management Call Detail Recording (CDR) Package shall be provided for all voice circuits. The TMS shall:
      1) Include all necessary hardware, software, and interconnections to the CSU.
      2) Contain a database that shall be stored on non-volatile media. Tape drives are not acceptable.
      3) Contain line numbers, physical locations of equipment by building and room number, the department to which a line is assigned, the name of the person(s) assigned to a particular number, the type of equipment, and any comments regarding CSU features.
      4) Support additional I/O ports for video monitors or other terminals, which will allow a passive display of the data base(s) by, authorized medical center personnel other than those individuals responsible for data input and conducting studies.
      5) Exhibit a method of security that shall be provided by User ID and password to protect the data base(s).
      6) Perform separate voice line reports, on demand and predetermined schedule, for automatic printing. As a minimum, the following reports are required:
         a) Originating trunk traffic by trunk group expressed in CCS.
         b) Terminating trunk traffic by trunk group expressed in CCS.
         c) All trunk busy, by trunk group, expressed as blocked call count.

d) All equipment busy, i.e., no dial tone and failure to complete cross office call because of all equipment busy, expressed in blocked call count.

e) List of all equipment alarms, error tables, trouble logs, history files, V & H coordinates etc.

7) Perform the following console measurements for each console:

a) Incoming calls.

b) Calls answered.

8) Contain remote video monitors that shall be provided in the immediate vicinity of the telephone operators for use as an on-line directory lookup system of Facility personnel. The Contractor provided monitors shall be compatible with the proposed TMS hardware and software.

9) Produce reports that shall be in English notation and will not require interpretation of abbreviations or codes by the user.

10) Contain sufficient storage on disk shall be provided to prevent a purge of stored data. Call record and facility usage data shall be maintained in the database for a minimum of 30 days. Storage must be capable of accommodating a minimum of 5,000 calls per day.

e. Samples of all reports generated by the TMS are to be submitted with the technical submittal for evaluation of formats and compliance with information field content.

f. Detailed description of the method to be used to measure traffic data shall be included in the technical submittal.

g. Normal system traffic data shall be furnished to the appropriate Facility staff within seven days of a Facility request. A complete and comprehensive traffic study, to include the required traffic data with the Contractor's comments and recommendations, will be prepared and submitted to the appropriate Facility staff quarterly. These studies shall be provided at no additional cost to the VA.

h. Automatic directory service shall generate a telephone directory that includes, name, title, organization, location, extension, and class-of-service. The Contractor shall be responsible for loading and maintaining the directory.

i. A Cable plant management function shall be provided with the following requirements, at a minimum:
   1) A list of off-premise cable by circuit number, numbers of pairs for each circuit, and circuit definition.
   2) Provide a complete cable plant distribution record to identify the location (cable pair) on the MDF, the riser, the size cable, cable pair in-use (main cable feeder and station cable), building and room number of the termination, and the type equipment terminated.
   3) Automatically provide when the service order is entered, the cable number and pair assignments.

j. Equipment inventory list shall be provided containing the following minimum requirements:
   1) CSU cabinets, cards (active and spares), batteries, current and surge protectors, rectifiers, all peripheral equipment, i.e. radio page, audio page, etc.
   2) Quantity of single and multi-line telephones, speakerphones, dial intercom units, speakers, gongs, loud horns, bells, chimes, recorders, etc.
   3) A list of equipment as being used or spare; ordered or received; installed date, warranty date, cost, location, serial number, etc.

C. Equipment Cabinet with Internal Mounting Rack:
   1. The equipment cabinet shall be lockable, heavy gauge steel with baked on paint finish. It shall be floor or wall mounted with knock-out holes for cable entrance and conduit connection, provided with ventilation ports and quiet fan with non disposable air filter for equipment cooling. Two keys shall be provided for each lock to the RE when the System is accepted.
   2. A minimum of one cabinet shall be provided with blank rack space, for additional equipment. Blank panels shall be installed to cover any open or unused rack space. Two 120 VAC power strips connected to surge protectors, cooling fan with non-disposable air filter, and conduit or cable duct interface to adjacent cabinet(s) shall be a part of this cabinet.
   3. Blank panels shall be color matched to the cabinet, 3.175 mm (1/8”) aluminum with vertical dimensions in increments of 44 mm (1.75”)

with mounting holes spaced to correspond to Electronic Industry Association (EIA) 480 mm (19”) dimensions. Single standard size blank panels shall be used to fill unused panel or rack spaces in lieu of numerous 44 mm (1.75”) types. One blank 44 mm (1.75”) high blank panel shall be installed between each item of equipment.

4. AC Power Outlet Strip(s):
   a. A strip shall be provided with an outlet for each item of equipment and a minimum of four spare AC power outlets. Each strip shall be mounted inside and at the rear of each equipment cabinet. It shall contain “U” ground AC outlets for distributing AC power to the installed electronic equipment. The strip shall be self-contained in a metal enclosure with a maximum of 1.8 M (6-foot) connecting wire with three-prong plug.
   b. Technical Characteristics:

Power capacity	20 Ampere (AMP), 120 VAC continuous duty
Wire gauge	Three conductor, #12 AWG copper

5. Cabinet AC Power Line Surge Protector and Filter:
   a. Each cabinet containing active electronic equipment shall be equipped with a AC Surge Protector and Filter. The Protector and Filter shall be housed in one single enclosure. The Protector and Filter shall provide instantaneous regulation of the AC input voltage and isolate and filter any noise present on the AC input line. It shall be cabinet mounted and the cabinet AC power strip (two strips maximum) may be connected to it.
   b. Technical Characteristics:

Input Voltage range	120 VAC + 15%
Power capacity	20 AMP, 120 VAC
Voltage output regulation	+3.0%
Circuit breaker	15 AMP, may be self contain
Noise filtering	Greater than 45 dB
AC outlets	Four duplex grounded types, minimum
Response time	5 Nano Seconds

Surge suppression	10,000 AMPS
Noise suppression	
Common	-40 dB
Differential	-45 dB

6. Main AC Input Line:
   a. The CSU shall be equipped with AC voltage and current surge protectors to prevent damage to the CSU and rectifiers from power line induced voltage spikes, surges, lightning, etc.
   b. Specific requirements for current and surge protection shall include:
      1) Five nanosecond (ns) response time to the transient.
      2) Voltage protection threshold, line to neutral, starts at no more than 220 volts peak. The transient voltage shall not exceed 300 volts peak. Vendor shall furnish documentation on peak clamping voltage as a function of transient AMP.
      3) Peak power dissipation is 35 joules per phase (minimum), as measured for l millisecond at sub branch panels, l00 joules per phase at branch panels and 300 joules per phase at service entrance panels. Vendor shall furnish an explanation of how the ratings were measured or empirically derived.
      4) Surge protector must not short circuit the AC power line at any time:
         a) The primary surge protection components must be silicon semiconductors. Secondary stages, if used, may include other types of devices.
         b) Surge protectors shall incorporate a visual device which indicates whether the surge suppression component(s) is (are) functioning.
         c) Surge protection devices shall be UL listed.
         d) Voltage and current surge protectors shall be provided on all ancillary equipment provided by the Contractor, not powered from the CSU primary power supply and emergency battery, e.g., electronic telephones, service units, custom telephones, speaker phones, modems, data terminal interface, etc.

e) Power dissipation 12,000 Watts (W) for l millisecond (l2 Joules).

f) Voltage protection threshold starts at not more than 110 VAC.

g) Surge protectors must not short-circuit the A/C line at any time.

h) Surge protectors shall be wholly self contained, plug in type for 110/120 VAC, 15 AMP, duplex receptacle.

D. Environmental Cabinet (If Selected):

1. The Contractor shall provide this enclosure in lieu of a standard equipment cabinet identified in Paragraph 2.3.A to meet system design in hostile TC locations as identified on the drawings. The enclosure shall fully sustain the installed, including electronic, equipment in the same manner as the standard cabinet identified in Paragraph 2.3.A. Additionally, the enclosure shall fully support all installed equipment as if they were in a stand alone air handling area regardless of the local area's air handling capabilities. The enclosure shall be a fully OEM assembled unit. If more than two enclosures are required in any system location, those enclosures shall be OEM assembled for consolidating or combining two or more enclosures in a single unit to meet system space and equipment handling designs.

2. Technical Characteristics:

Environmental control	Automatic, heating and/or cooling, as required
Temperature conditions (rated at 1,300 W of install equipment heat generation):	
Internal Range	Maintains 80° to 105° of internal heat conditions, maximum
External Range	100° ± 25°, maximum
Forced air unit	Required with non disposable air filter unobstructed and uninterruptible
Air conditioning	As required, fully internal mounted
Heater	As required, fully internal mounted
Uninterruptible power supply	As required, fully internal mounted

Front door	Full length, see through, EMI resistant, and lockable
Rear door	Full length, non-see through, EMI resistant, and lockable
Conduit wiring entrance	Top and/or bottom, fully sealed
Input power	2 ea. minimum 120 VAC @ 20A, maximum, independent circuit, conduit for fixed or armored cable for moveable installations
Dimensions:	
Height	1980 mm (78”), maximum
Width	635 mm (25”), maximum
Depth	965 mm (38”), maximum
Front panel opening	480 mm (19”), w/ EIA mounting hole spacing

E. Distribution or System Interface Cabinet:

1. The cabinet shall be constructed of heavy 16 gauge cold rolled steel, have top and side panels and hinged front and rear (front door only if wall mounted) doors. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using Facility Service Chief or the COTR, contain integral and adjustable predrilled rack mounting rails or frame that allows front panel equipment mounting and access. When all equipment, doors and panels are installed, snap-in-place chrome trim strip covers are required to be installed that will cover all front panel screw fasteners. It shall be equipped in the same manner as the equipment cabinet.
2. Technical Characteristics:

Overall height	2180 mm (85 7/8"), maximum
Overall depth	650 mm (25 1/2"), maximum
Overall width	535 mm (21 1/16"), maximum
Equipment vertical	1960 mm (77 1/8”), maximum
mounting space	
Front panel horizontal	484 mm (19 1/16”), maximum,
width	

F. Stand Alone Equipment (Or Sometimes Called Radio Relay) Rack:

1. The rack shall be constructed of heavy 16 gauge cold rolled steel and have fully adjustable equipment front mounting rails that allows front panel equipment mounting and access. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using Facility Service Chief or the COTR. It shall be floor or wall mounted or mounted on casters as directed by the COTR.
2. Technical Characteristics:

Overall Height	2180 mm (85 7/8"), maximum
Overall Depth	650 mm (25 1/2"), maximum
Overall Width	535 mm (21 1/16"), maximum
Front Panel Opening	480 mm (19"), EIA horizontal width
Hole Spacing	per EIA

G. Cross-Connection System (CCS) Equipment Breakout, Termination Connector (or Bulkhead), and Patch Panels:

1. The connector panel(s) shall be made of flat smooth 3.175 mm (1/8 inch) thick solid aluminum, custom designed, fitted and installed in the cabinet. Bulkhead equipment connectors shall be mounted on the panel to enable all cabinet equipment’s signal, control, and coaxial cables to be connected through the panel. Each panel shall be color matched to the cabinet installed.
   a. Voice (or Telephone):
      1) The CSS for voice or telephone service shall be Industry Standard 110 type punch blocks. This represents the minimum requirement for voice or telephone, and control wiring in lieu of patch panels, each being certified for category six service. IDC punch blocks (with internal RJ45 jacks) are acceptable for use in all CCS and shall be specifically designed for category six telecommunications service and the size and type of UTP cable used as described herein. As a minimum, punch block strips shall be secured to an OEM designed physical anchoring unit located on a wall in the MTC, IMTC, and TC. However, console, cabinet, rail, panel, etc.

mounting is allowed at the OEM's recommendation and as approved by the COTR. Punch blocks shall not be used for Class II or 120 VAC power wiring.

2) Technical Characteristics:

Number of horizontal rows	100, minimum
Number of terminals per row	4, minimum
Terminal protector	required for each used or unused terminal
INSULATION SPLICING	required between each row of terminals

b. Fiberoptic:

1) Product reference of a Government Approved (US State Department) type is Telewire, PUP-17 with prepunched chassis mounting holes arranged in two horizontal rows. This panel may be used for fiber optic, audio, control cable, and Class II Low Voltage Wiring installations when provided with the proper connectors. This panel is not allowed to be used for 120 VAC power connections.

2) Technical Characteristics:

Size:	
Height	Two RUs, 89 mm (3.5") minimum
Width	484 mm (19 1/16"), EIA minimum
Number of connections	12 pairs, minimum
Connectors:	
Audio Service	Use RCA 6.35 mm (1/4") Phono, XL or Barrier Strips, surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained)
Control Signal Service	Barrier strips surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained)
Low voltage power	Barrier strips with spade lugs and

(class II)	clear full length plastic cover, surfaced mounted
FIBER OPTIC	“ST” STAINLESS STEEL, FEMALE

c. Mounting Strips and Blocks:

1) Barrier Strips:

a) Barrier strips are approved for AC power, data, voice, and control cable or wires. Barrier strips shall accommodate the size and type of audio spade (or fork type) lugs used with insulating and separating strips between the terminals for securing separate wires in a neat and orderly fashion. Each cable or wire end shall be provided with an audio spade lug, which is connected to an individual screw terminal on the barrier strip. The barrier strips shall be surface secured to a console, cabinet, rail, panel, etc. 120 VAC power wires shall not be connected to signal barrier strips.

b) Technical Characteristics:

Terminal size	6-32, minimum
Terminal Count	Any combination
Wire size	20 AWG, minimum
Voltage handling	100 V, minimum
Protective connector cover	Required for Class II and 120 VAC power connections

2) Solderless Connectors: The connectors (or fork connectors) shall be crimp-on insulated lug to fit a 6-32 minimum screw terminal. The fork connector shall be installed using a standard lug-crimping tool.

3) Punch Blocks: Industry Standard 110 type punch blocks are approved for data, voice, and control wiring at a minimum. Punch blocks shall be specifically designed for the size and type of wire used. Punch block strips shall be secured to a console, cabinet, rail, panel, etc. Punch blocks shall not be used for Class II or 120 VAC power wiring.

4) Wire Wrap Strips: Wire wrap strips (minimum of 1.65 mm (0.065") wire wrap) are approved for voice and control wiring and shall meet Industry Standards. Wire wrap strips shall be secured to a cabinet, rail, panel, etc. Wire wrap strips shall not be used for Class II or 120VAC power wiring.

H. Wire Management System and Equipment:

1. Wire Management System: The system(s) shall be provided as the management center of the respective cable system, CCS, and TC it is incorporated. It shall perform as a platform to house peripheral equipment in a standard relay rack or equipment cabinet. It shall be arrange in a manner as to provide convenient access to all install management and other equipment. All cables and connections shall be at the rear of each system interface to IDC and/or patch panels, punch blocks, wire wrap strips, and/or barrier strip.
2. Wire Management Equipment: The wire management equipment shall be the focal point of each wire management system. It shall provide an orderly interface between outside and inside wires and cables (where used), distribution and interface wires and cables, interconnection wires and cables and associated equipment, jumper cables, and provide a uniform connection media for all system fire retardant wires and cables and other subsystems. It shall be fully compatible and interface to each cable tray, duct, wireway, or conduit used in the system. All interconnection or distribution wires and cables shall enter the system at the top (or from a wireway in the floor) via a overhead protection system and be uniformly routed down either side (or both at the same time) of the frame in side protection system then laterally via a anchoring or routing shelf for termination on the rear of each respective terminating assembly. Each system shall be custom configured to meet the system design and user needs.

I. Telephone Instruments:

1. Telephone instruments (or station equipment) that are initially installed shall be configured as indicated herein. Final location of some station equipment shall be coordinated with designated VA official prior to installation.
2. All telephone instruments shall be equipped with the inductive capability to radiate a magnetic field required to activate the

hearing aid telecoil and to provide personnel, who use hearing aids, access to all telephones within the Facility.

3. Station equipment shall consist of standard single line instruments, patient bedside instruments, and multi-line digital electronic telephone instruments with digital display, of the latest state-of-the-art design.
4. All telephone instruments except patient bedside phones, shall be equipped with a flash button (or equivalent feature button) with pre-determined timing feature to initiate consultation hold and other features normally initiated by operation of the hook-switch. Flash button shall be distinct from the hook-switch.
5. All telephone instruments, except patient bedside phones, shall be equipped with a laminated faceplate listing the most common user features and their appropriate access codes. The faceplates may be an integral part of the instrument housing or may be an adhesive backed decal that shall be applied over the tone pad area of the housing at the time of telephone set installation.
6. Station instruments shall be feature compatible and have transmission characteristics which are compatible with the proposed system.
7. Telephone instrument signaling shall be by means of standard adjustable, buzzers, chimes, or electronic tone, unless otherwise specified:
   a. Single Line:
      1) Single line instruments may be electronic or 2500-type analog phones.
      2) Single line instruments used must be capable of supporting bridged cabling to allow a single phone number on multiple instruments without using multiple switch ports.
      3) Single line instruments must be capable of supporting auxiliary equipment, such as amplified handsets; external chimes, light, or bells; and other similar equipment without using multiple switch ports.
   b. Multi-Line, Digital and Electronic:
      1) The instruments shall be equipped with a digital read-out display and shall have no less than 14 programmable (lines or features) buttons.

2) The instruments shall employ only one adjustable ringer, bell, buzzer, chime or electronic tone to announce calls. The signaling device shall detect an incoming call to the multi-button instrument and provide an audible signal only on designated lines.
3) Each instrument shall be equipped with lights to identify the called line and remain illuminated for the duration of the call.
4) Telephone intercom systems shall normally be associated with these instruments.
5) The equipment associated with intercom systems may require special features such as built in microphone and speaker. Telephone Intercom Systems shall be required to provide secretaries with a means of announcing calls to offices with extensions or pickups on the system. The provision of intercom systems shall be identified during the data base survey required as described herein. Any required intercom systems shall be provided and installed by the Contractor.
6) This equipment must be capable of supporting auxiliary equipment, such as amplified handsets; external chimes, light, or bells; and other similar equipment. The use of analog switch ports to provide ringing voltage, if required, is acceptable and these switch ports shall be included in the Equipped Capacity as described herein.
7) Hot Line Telephones shall be provided between two identified points and as shown on the drawings. These hot lines shall be equipped with two-way automatic ring and cut-off controlled by the telephone hook-switch, i.e. when near-end hand set is removed from the hook switch, the far-end telephone shall ring until the hand set is removed from the hook-switch.
8) Hands Free telephone stations shall be required. In this configuration, a speaker shall be used as both transmitter and receiver to answer or initiate a call. These facilities will normally be used as a hot line between two points. Requirements for hands-free operated facilities shall be identified on the drawings.

c. Patient Bedside:

1) Patient bedside instruments shall be maintenance free, sanitized packet, and capable of supporting tabletop, side-rail, top bed-rail, or wall mounting. Each phone should have a self-contained line cord of not less than 4.5 M (15 feet).

2) At the discretion of the facility, patient bedside instruments may be discarded, cleaned for reuse, or given to the patient, as appropriate. The anticipated cost per instrument should not exceed $10.00.

2.3 DISTRIBUTION EQUIPMENT AND SYSTEMS

The System shall be provided with a complete cable backbone and building distribution system consisting of copper, fiberoptic, and other specified cable and connectors, signal closets, cross connection or terminating systems, telecommunication outlets and interface points as identified in Specification Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING and with technical instructions and approval from the COTR.

2.4 INSTALLATION KIT

The kit provided shall include, at a minimum, all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. The Contractor shall turn over all unused and partially opened installation kit boxes, coaxial, fiber-optic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware to the COTR. At a minimum, the following installation sub-kits are required:

A. System Grounding:

1. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.

2. This includes, but is not limited to:

a. Coaxial Cable Shields
b. Control Cable Shields.
c. Data Cable Shields.
d. Equipment Racks.
e. Equipment Cabinets.
f. Conduits.
g. Cable Duct.
h. Cable Trays.
i. Power Panels.
j. Connector Panels.
k. Grounding Blocks.

B. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.

C. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.

D. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.

E. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, Record Wiring Diagrams, and this document.

F. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Product Delivery, Storage and Handling:

1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment model and serial identification numbers. The COTR may inventory the EPBX and related equipment.
2. Storage and Handling: Store and protect equipment in a manner that will preclude damage as directed by the COTR.

B. System Installation:

1. After award of contract, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the system without written approval from the COTR and PM.
2. The Contractor shall install all equipment and systems in a manner, which complies with, accepted industry standards of good practice, the requirements of this specification and in a manner that does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.
3. The Contractor shall install suitable filters, traps, directional couplers, splitters, telephone outlets, and pads for minimizing interference and for balancing the amplifiers and distribution system(s). Items used for balancing and minimizing interference shall be able to pass telephone channels in the frequency bands selected, in the directions specified, with low loss, and high isolation and with minimum delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements of paragraph 2.1.C and the System performance standards.
4. All passive equipment shall be connected according to the OEM's specifications to insure correct termination, isolation, impedance match and signal level balance at each telephone outlet.
5. Where telephone/data outlets are installed adjacent to each other, install one outlet for each instrument.

6. All lines shall be terminated in a suitable manner to facilitate future expansion of the System. There shall be a minimum of one spare 25 pair cable at each distribution point on each floor.
7. All vertical and horizontal copper and fiber optic lines shall be terminated so shall require modifications of the System CSU or signal closet equipment only.
8. Terminating resistors or devices shall be used to terminate all unused branches, outlets, equipment ports of the System, and shall be devices designed for the purpose of terminating fiber optic or twisted pair cables carrying digital signals in telephone systems.
9. Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two keys.

C. Equipment Assembly:

1. Cabinets:
   a. Each enclosure shall be: Floor or wall mounted with standard knockout holes for conduit connection or cable entrance; provide for ventilation of the equipment; have front and rear locking doors (except, wall mounted cabinets that require only a front locking door); power outlet strip(s), connector, and patch panel(s).
   b. Each enclosure shall be equipped with a quiet fan and nondisposable air filter.
   c. Enclosures and stand alone racks shall be installed plumb and square. Each shall be permanently attached to the building structure and be held firmly in place and approved by the COTR.
   d. Rack mounted equipment shall be installed in the enclosure’s equipment adjustable mounting racks with equipment normally requiring adjustment or observation mounted so operational adjustment(s) can be conveniently made. Heavy equipment shall be mounted with rack slides or rails allowing servicing from the front of the enclosure. Heavy equipment shall not depend only upon front panel mounting screws for support. Equipment shall be provided with sufficient cable slack to permit servicing by removal of the installed equipment from the front of the enclosure. A color matched blank panel (spacer) of 44 mm (1.75 inches) high, shall be installed between each piece of equipment (active or passive) to insure adequate air circulation. The

enclosure shall be designed for efficient equipment cooling and air ventilation.

e. Provide 380 mm (15 inches) of front vertical space opening for additional equipment. Install color matched blank panels to cover any unused enclosure openings.

f. Signal connector, patch, and connector panels (i.e. PA, telephone, control, RF, TV, etc.) shall be connected so that outputs from each source, device or system component shall enter the panel at the top row of jacks, beginning left to right as viewed from the front. These will be called "inputs". Each connection to a load, device or system component shall exit the panel at the bottom row of jacks, beginning left to right as viewed from the front. These will be called "outputs".

1) Equipment located indoors shall be installed in metal racks or enclosures with hinged doors and be accessible for maintenance without interference to other nearby equipment.

2) Cables shall enter the equipment racks or enclosures in such a manner that allows all doors or access panels to open and close without disturbing or damaging the cables.

3) All distribution hardware shall be securely mounted in a manner that allows access to the connections for testing and provides sufficient room for the doors or access panels to open and close without disturbing the cables.

2. Installation of the CSU:

a. General:

1) The CSU installation shall comply with all laws and codes applying to interconnected telephone installations.

2) In the absence of specifications regarding installation details, standard industry practices shall prevail and first quality material and workmanship shall be provided.

3) All material, installed by the Contractor, shall be new and thoroughly tested. All installation shall be carried out in a professional manner.

4) Installation of all equipment shall be fully coordinated with the COTR and Facility staffs. No area shall be left without minimal telephone service as described herein.

5) The Contractor shall provide an outlet with triplex modular jack with stainless steel cover plate for each telephone outlet as shown and verified on the drawings. The Contractor shall provide the appropriate modular jack (single or triplex) with appropriate cover plate for each 'outlet' location identified on the drawings.
6) The Contractor shall install all patient and wall telephone instruments on a single modular jack designed for wall telephone instruments and patient wall or PBPU installations.
7) All permanent telephone cable and wire shall be installed in conduit or an enclosed duct system or be of the type approved for installation, as determined by VA requirements, without conduit or enclosed duct system. Cable and wire not installed in conduit or an enclosed duct system must be installed in cable tray or mechanically supported and separated from other signal cable systems as described herein.
8) Where cable and wire penetrate through fire/smoke partitions, firewalls, or floors, the Contractor shall provide fire/smoke stopping around the outside of any installed conduit/cable tray. The Contractor shall provide and install fire stopping material, type approved by the COTR, inside the provided conduit/cable tray after installation is complete.

b. The Contractor Shall:
1) Install the equipment in accordance with the specifications for the CSU as specified and recommended by the OEM.
2) Provide a full time on-site Project Manager effective with VA issuance of the notice to proceed. The Project Manager shall be responsible for fully coordinating and supervising all contractor/sub-contractor personnel in all phases of the installation, training, inspection, cutover, and final acceptance of the System. The Project Manager shall be provided a complete copy of these specifications to include all amendments prior to the start of installation of the telephone system.
3) Coordinate and conduct the CSU data base survey with the COTR and a member of the IRM staff. The Contractor is responsible for identifying all programming of features, classes of

service, and equipment to be installed by types and physical locations as specified in this document and all attachments thereto. After the survey is completed, a complete list of equipment shall be provided to the COTR and the IRM for approval prior to the start of installation.

4) Be responsible for the removal and replacement of damaged ceiling tiles during installation and maintenance service of the cable and wire distribution system. The Contractor shall be responsible for restoring to original condition any immediate (approximately one meter (three feet) in diameter) areas that were damaged during the installation and maintenance of the systems.
5) Run all cross connects to established circuits during installation and maintenance service for the contract life.
6) Remove, on a daily basis, all debris and scrap generated in the conduct of work.
7) Provide the COTR, for review, coordination and approval, a Proof of Performance Test Plan 90 days prior to activation of the CSU. The plan shall be used for testing and acceptance of the System. It shall include sufficient tests to demonstrate the systems capabilities of providing the services outlined in this document. Test equipment required for demonstration shall be Contractor provided and approved by the COTR. A list of test equipment required shall be included with the acceptance test plan. Test equipment shall have under gone calibration certification within six months prior to system activation.
8) Provide Contractor personnel (switch technicians, installers, trainers, and the project manager) on premise for seven consecutive days after cut-over to clear any malfunctions which may develop, to assign/reassign any software features/COS, and conduct any additional training as required.
9) Ensure that the project manager and sufficient skilled personnel remain on premise until all items on the punch list, developed during inspection, cut-over, and acceptance testing of the System are completed, inspected, and accepted by the COTR.

10) Be responsible for any and all coordination with the LEC relative to interface with the commercial telephone system. The Contractor shall also be responsible for the removal of all voice and/or data equipment and cabling abandoned by the LEC, VA, or other organizations and not retained for exclusive use by VA as a result of this installation.
11) Connect all telephone equipment located in the equipment room to the common signal ground buss that is provided. The common signal ground buss shall be located in all telephone closets and the CSU switch room.
12) Provide system ground between CSU and all interfaced systems such as existing telephone system, PA system equipment chassis, radio paging equipment chassis, etc.
13) Ensure that other dedicated telecommunications systems applications within the Facility (i.e., pay stations, electro-writing equipment, facsimile etc.) that require space within switch room/telephone closets, conduits, and cable pair are accommodated. Coordination between applicable parties will be necessary to ensure accommodation of these systems. It shall be the responsibility of the bidders to determine the requirements and include them in their proposal.
14) All portions of the System installation shall conform to local building and fire codes.
15) The Contractor shall not use gasoline, benzene, alcohol, naphtha, carbon tetrachloride, or turpentine for cleaning any part of the equipment. Flammable materials shall be kept in suitable places outside the building. OSHA safety standards and local Facility safety standards shall prevail.

D. Conduit, Cables and Wiring, Cable Tray, Raceways, Signal Ducts, Etc.:
1. The Contractor shall employ the latest installation practices and materials.
2. All cables shall be installed in conduit and/or signal ducts. Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
3. Ensure that Telephone and PA Systems (as identified by NEC Section 517) are completely separated and protected from all systems.

4. All cable junctions and taps shall be accessible. Do not install multi-taps or other distribution equipment items inside cable ducts or raceways. As a minimum, use a 200 mm x 200 mm x 100 mm (8″ X 8″ X 4″) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible.
5. Cables shall be installed and fastened without causing sharp bends or rubbing of the cables against sharp edges. Cables shall be fastened with hardware that will not damage or distort them.
6. Cables shall be labeled with permanent markers at the terminals of the electronic and passive equipment and at each junction point in the System. The lettering on the cables shall correspond with the lettering on the record wiring diagrams.
7. Cable shall be grouped and shall not change position throughout the cable run.
8. Completely test all of the cables after installation and replace any defective cables.

3.2 TESTS

If this Section is being used in conjunction with Specification Section 27 31 00, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT or Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING , the following testing guidelines are in addition to the requirements outlined in these documents. If this document is being used as a “Stand Alone” cable plant installation, the following testing guidelines shall be the standard of measure for the respective system.

A. Interim Inspection:
   1. The interim inspection will be conducted in the presence of a Government Representative designated as the VA Contract Coordinator prior to the proof of performance testing. This inspection shall verify that the equipment provided adheres to the installation requirements of this document.
   2. The Contractor shall have 50% of the telephone extension system equipment installed to include, but not be limited to: CSU, interface, origination and junction enclosures powered with the permanent AC wiring, outlets, conduit and cables, before the interim inspection can take place.

3. The Contractor shall notify the COTR, in writing, of the estimated date the Contractor expects to be ready for in the interim inspection, at least (7) working days before the requested inspection date.
4. Results of the interim inspection shall be provided to the COTR and PM. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor the Contractor to continue with the System installation.
5. The COTR in conjunction with PE shall determine if an additional inspection is required, or if the Contractor will be allowed to proceed with the installation. In either case, re-inspection of deficiencies noted during the interim inspection(s), will be part of the proof of performance test. The interim inspection shall not affect the systems' completion date. The Contracting Officer shall ensure all test documents will become a part of the systems record wiring diagrams documentation.

B. Pretesting: Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.

C. Pretesting Procedure: During the System pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the System performance requirements of this document. The Contractor shall measure and record the aural carrier levels of each system telephone, at each of the following points in the system:
   1. Local Telephone System Inputs.
   2. CSU inputs and outputs.
   3. MDU, BIU, amplifiers, channel processor and converter inputs and outputs.
   4. CSU output S/NR for each telephone channel.
   5. Signal Level at each interface point to the distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.
   6. A copy of the recorded system pretest measurements shall be submitted, along with the pretest certification, to the COTR.

D. Pretesting Certification. After pretesting the System, the Contractor shall notify the COTR, in writing, that the System is ready for proof

of performance testing, and that it meets all requirements stated in this document. The Contractor shall accomplish submission of this notification of system readiness, no later than (20 working days prior to the beginning of the scheduled Government proof of performance test. Failure of the Contractor to comply with these pretest requirements, shall be grounds for canceling the scheduled test.

E. Acceptance Test:

1. After the System has been pretested and the Contractor has submitted the pretest results and certification to the COTR, the Contractor shall schedule an acceptance test date and give the COTR 20 days advance written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total system meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
2. The acceptance test shall be performed on a “go-no-go” basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed system complies with the operational and technical requirements of this specification under operating conditions. The System shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the System the precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to effect repairs, shall cause the entire System to be declared unacceptable. Re-testing of the entire System shall be rescheduled at the convenience of the Government.

F. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:
   a. The Government Representative will tour all major areas where the System is and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare

parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.

b. The System diagrams, record drawings, equipment manuals, Auto CAD disks, interim inspection and pretest results shall be formally inventoried and reviewed.

c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.

2. Operational Test: After the Physical and Mechanical Inspection, the Contractor shall perform an operational test to verify that all equipment is properly connected, interfaced and is functionally operational to meet the requirements of this specification. If any sub-system is not functionally ready, that sub-system shall be declared unacceptable and all testing shall be terminated. At this point, the Contractor shall be permitted one hour to correct the deficiencies. It may be mutually agreed upon, at this time, to wait one hour or to commence testing of the next sub-system.

3. Performance Test: After the functional test, each sub-system shall be checked to verify that all performance requirements and standards are met. The performance requirements shall be verified using the necessary test equipment. A spectrum analyzer, signal level meter and BERT shall be used to verify there are no visible signal distortions, such as inter-modulation, beats, etc. appearing on any received or generated telephone channel.

4. Total System Test:

a. The testing shall proceed until the system and subsystems are functionally tested and accepted. The total system tests shall verify that the requirements have been met for all system signals as described herein.

1) Existing Telephone System Point of Demarcation: The system output(s) shall be checked to verify that all performance requirements are met.

2) CSU: This test shall be conducted within 30 days following successful pre-testing of the CSU. In addition to compliance with the technical characteristics and quantities of equipment specified herein, the Final Acceptance Test shall contain the provision that 30 continuous days uninterrupted telephone

service, must be completed prior to the Contractor being deemed to be in compliance with the contract.

b. For the purpose of final acceptance, the telephone service shall be considered interrupted when the failure of any Contractor provided telephone equipment including batteries, results in an interruption of service. This includes a failure of more than 20% of any trunk group, 15% of any number group (15 or more stations), operator console, or telephone service to any area determined to be critical by the Facility Director. Response time to restore service shall have no bearing upon the term "interrupted service".

c. To facilitate the CSU Acceptance Test and to allow familiarization and training of Facility employees, the Contractor shall activate the CSU, including the operator consoles, stations and equipment a minimum of 30 days prior to the acceptance test date. All installed equipment and circuits shall be fully tested prior to the acceptance by VA. During this "burn-in" period, the Contractor shall de-bug the CSU. The Contractor shall make the CSU available for in-house communications and demonstrate to the Facility staff the required features. The Facility Director and Contractor will make designated trunks and tie-line circuits available to the CSU during this "burn-in" period for testing.

d. At the conclusion of the Acceptance Test, the PM, the COTR and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages, if any. When the test show s the System performs in accordance with the specifications, the (30) days of uninterrupted service provision shall begin. This provision must be successfully met for contract compliance. If any retests are needed to reach agreement on the results of the tests or to establish compliance with these specifications such retesting will be done at the Contractor's expense.

5. Individual Item Test: The Government Representative may select individual items of equipment for detailed proof-of-performance testing. That item shall meet or exceed the minimum requirements of the specification.

6. Distribution System:
   a. To ensure that the System meets all performance requirements, a minimum of 75% of the System outlets shall be checked. Additionally, each distribution system interface, junction and connection point or location will be checked. Each distribution active and passive item of equipment, signal input(s) and output(s) will be tested.
   b. For specific distribution testing instructions refer to Specification Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING, and the COTR for technical assistance.

3.3 TRAINING

A. Furnish the services of an OEM trained and certified engineer or technician for a total of (two) eight hour classes to instruct designated Facility maintenance personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment. Training shall be accomplished before the VA can accept the System. Additionally, training will be scheduled at the convenience of the Facility’s, Chief Engineering Service.

B. Also, furnish the services of an OEM trained and certified engineer or technician, familiar with the functions and operation of the system and equipment, for two eight hour periods to train designated Facility IRM personnel. Instructions shall be provided for staff personnel in each area where the System is installed under this contract. When multiple areas are involved, classes will be grouped. Periods of training shall be coordinated with the COTR. The COTR shall coordinate with the Facility to ensure all shifts receive the required training. Each session shall include instructions utilizing “hands-on” operation and functions of the System.

3.4 SYSTEM GUARANTEE

A. Contractor’s Responsibility: The Contractor shall guarantee that all installed material and equipment will be free from defects, workmanship, and will remain so for a period of one year from date of final acceptance of the System by VA. The Contractor shall provide OEM’s equipment warranty documents, to the COTR, certifying that all equipment installed under this document conforms to its published specifications.

B. The Contractor shall provide a written commitment from the System equipment OEM to the supply of parts and on-site engineering support services for the one year guarantee service (materials and labor) in the event of default or unsatisfactory service by the Contractor.
   1. The OEM certification shall describe, in the event of default or unsatisfactory service by the Contractor, the manufacturer or an authorized distributor shall fully support the contract (initial installation, guarantee service for the one year warranty period of the contract).
   2. The System equipment OEM’s signatory of the certified written commitment must be of an individual who has the full authority to obligate the OEM to this commitment. Names, corporate addresses, and telephone numbers of the individuals who have this authority shall be provided as a part of the commitment.

C. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM's central emergency maintenance and request remote diagnostic testing and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.

D. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of their current and qualified OEM training certificates and OEM certification upon request.

E. Additionally, the Contractor shall accomplish the following minimum requirements during the one year guarantee period:
   1. Response Time:
      a. The COTR is the Contractor’s reporting and contact officials for the System trouble calls, during the guarantee period.
      b. A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.
      c. The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
         1) A routine trouble call within one working day of its report. A routine trouble is considered a trouble that causes a sub-system to be inoperable.

2) An emergency trouble call within eight (8) hours of its report. An emergency trouble is considered a trouble that causes a system to be inoperable at anytime.
   a) An emergency trouble call shall be deemed appropriate when a failure involves more than 20 voice circuits.
   b) In addition, the failure of a common control unit, power supply, signal generating device or attendant console shall also be deemed as an emergency maintenance call.
3) A catastrophic trouble call within four (4) hours of its report. A catastrophic trouble call is considered a EPBX failure.
   a) If an EPBX failure cannot be corrected within six (6) hours, the Contractor shall be responsible for providing an alternate CSU equipped for a minimum of 100 station lines, 10 CO trunks, 10 FTS access lines and two operator’s consoles.
      (1) This alternate system shall be operational within 12 hours (time to commence at the end of the six-hour trouble shooting period) and shall provide emergency service to critical areas as determined by the Facility Director.
      (2) The alternate system shall be a programmable system and a pre-written compact disk program shall be provided to the COTR prior to cut-over of the main telephone system.
   b) Failures affecting operation of critical emergency health care facilities (i.e. cardiac arrest teams, intensive care units, etc.) shall also be deemed catastrophic trouble calls if so determined by the Facility Director. The COTR shall notify the Contractor of this type of trouble call at the direction of the Facility Director.
4) The Contractor shall respond on-site to installation of station or equipment requests or service within:
   a) Eight (8) hours for emergency installations designated by the COTR, and
   b) Three working days for routine installations designated by the COTR.

2. Required On-Site Visits During The One Year Guarantee Period:
   a. The Contractor shall visit, on-site, for a minimum of eight hours, once every twelve (12) weeks, during the guarantee period, to perform system preventive maintenance, equipment cleaning and operational adjustments to maintain the System according the descriptions identified in this specification.
      1) The Contractor shall arrange all Facility visits with the COTR prior to performing the required maintenance visits.
      2) The Contractor in accordance with the OEM’s recommended practice and service intervals shall perform preventive maintenance during non-busy time agreed to by the COTR and the Contractor.
      3) The preventive maintenance schedule, functions and reports shall be provided to and approved by the COTR.
      4) Provide on-site a stock of replacement spare parts and equipment, plus test equipment, as specified herein, ensuring they meet the OEM’s minimum recommended spare parts stock sizing requirements for this specific system.
   b. The Contractor shall provide the COTR a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the COTR sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
      1) The Contractor shall provide a monthly summary for all equipment and sub-systems serviced during the guarantee period to the COTR by the fifth working day after the end of each month. The report shall clearly and concisely describe the service rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventative and predictive maintenance.
      2) The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details to the nature and causes and the emergency steps taken

to rectify the situation and specific recommendations to avoid such conditions in the future.

c. The COTR shall convey to the Facility Engineering Officer, two (2) copies of actual reports for evaluation.

1) The COTR shall ensure a copy of these reports is entered into the System’s official acquisition documents.

2) The Facility Chief Engineer shall ensure a copy of these reports is entered into the system’s official technical as-installed documents.

3. Government Furnished Equipment (GFE). GFE that was accepted by the Contractor and interfaced and installed in this System shall become part of this System and included in the guarantee requirements.

- - E N D - -

SECTION 27 51 16
PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS - EXTENSION

PART 1 - GENERAL

1.1 SECTION SUMMARY

A. Work covered by this document includes design, engineering, labor, material, products, guaranty, training and services for, and incidental to, the complete installation of a new extension of the existing fully operating National Fire Protection Association (NFPA) Listed Emergency/Public Safety Public Address and Mass Notification communication (PA) system as detailed herein.

B. Work shall be complete, tested, labeled, certified and ready for operation

1.2 RELATED SECTIONS

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 Volts and Below)

C. Section 27 05 11, REQUIREMENTS FOR COMMUNCATIONS INSTALLATIONS

D. Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING

E. Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

1.3 DEFINITIONS

A. Provide: Design, engineer, furnish, install, connect complete, test, certify and guarantee.

B. Work: Materials furnished and completely installed.

C. Review of contract drawings: A service by the Engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The Engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.

D. Headquarters Technical Review, for National and VA communications and security, codes, frequency licensing, standards, guidelines compliance:

Office of Telecommunications
Special Communications Team (005OP2B)
1335 East West Highway – 3rd Floor
Silver Spring, Maryland 20910
(O) 301-734-0350, (F) 301-734-0360

E. Engineer: van Zelm, Heywood and Shadford, Inc.
10 Talcott Notch Road
Farmington, CT
(860) 284-5064

F. Owner: West Haven VA Medical Center

1.4 REFERENCES

A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:

1. United States Federal Law/Codes:

a. Departments of:

1) CFR, Title 15 – Department of Commerce, Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the:

a) Chapter II, National Institute of Standards Technology (NIST – formerly the National Bureau of Standards). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (Public Law 107-347), NIST develops – Federal Information Processing Standards Publication (FIPS) 140-2—Security Requirements for Cryptographic Modules.

b) Chapter XXIII, National Telecommunications and Information Administration (NTIA – aka ‘Red Book’) Chapter 7.8/9 Federal communications Commission (FCC) Title 47 (CFR), Part 15, Radio Frequency Restriction of Use and Compliance in “Safety of Life” Functions and Locations.

2) CFR, Title 29, Department of Labor, Chapter XVII - Occupational Safety and Health Administration (OSHA), Part 1910 – Occupational Safety and Health Standard:

a) Subpart 7 - Definition and requirements for a National Recognized Testing Laboratory (NRTL – 15 Laboratory’s, for complete list, contact http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html

(1) Underwriter’s Laboratories (UL):

65	Standard for Wired Cabinets.
468	Standard for Grounding and Bonding Equipment.
1449	Standard for Transient Voltage Surge Suppressors.
1069	Hospital Signaling and Nurse Call Equipment.
60950-1/2	Information Technology Equipment – Safety.

(2) Canadian Standards Association (CSA): same tests as for UL.

(3) Communications Certifications Laboratory (CCL): same tests as for UL.

(4) Intertek Testing Services NA, Inc. (ITSNA formerly Edison Testing Laboratory [ETL]): Same tests as for UL.

b) Subpart 35, Compliance with NFPA 101, Life Safety Code.

c) Subpart 36, Design and construction requirements for exit routes.

d) Subpart 268, Telecommunications.

e) Subpart 305, Wiring methods, components, and equipment for general use.

3) Title 42, CFC, Department of Health, Chapter IV Health and Human Services, Subpart 1395(a)(b) Joint Commission on Accreditation of Healthcare Organizations (JCAHO) “a hospital that meets JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:” All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.

4) All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.

5) CFR, Title 47 - Telecommunications, FCC: Part 15 – Restrictions of use for Part 15 listed Radio Equipment in Safety of Life/Emergency Functions/Equipment/Locations (also see CFR, Title 15 – Department of Commerce, Chapter XXIII – NTIA).

6) Public Law No. 100-527, Department of Veterans Affairs:

a) Office of Telecommunications:

(1) Handbook 6100, Telecommunications.

b) Office of Cyber and Information Security (OCIS):

(1) Handbook 6500, Information Security Program.

(2) Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.

c) Spectrum Management FCC and NTIA Radio Frequency Compliance and Licensing Program.

2. National Codes:

a. American Institute of Architects (AIA): Guidelines for Healthcare Facilities.

b. American National Standards Institute/Electronic Industries Association and Telecommunications Industry Association (ANSI/EIA/TIA):

568-B	Commercial Building Telecommunications Wiring Standards:
569	Commercial Building Standard for Telecommunications Pathways and Spaces.
606	Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
607	Commercial Building Grounding and Bonding Requirements for Telecommunications.
REC 127-49	Power Supplies.
RS 27	Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.

c. Institute of Electrical and Electronics Engineers (IEEE):

SO/TR 21730:2007	Use of mobile wireless communication and computing technology in healthcare facilities - Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.
0739-5175/08/$25.00©2008IEEE	Medical Grade – Mission Critical – Wireless Networks.

C62.41	Surge Voltages in Low-Voltage AC Power Circuits.

d. NFPA:

70	National Electrical Code (current date of issue) – Articles 517, 645 and 800.
75	Standard for Protection of Electronic Computer Data- Processing Equipment.
77	Recommended Practice on Static Electricity.
99	Healthcare Facilities.
101	Life Safety Code.

3. State Hospital Code(s).
4. Local Codes.

1.5 QUALIFICATIONS

A. The OEM shall have had experience with 3 or more installations of Public Address Systems of comparable size and complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least 1 year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.

B. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of 3 years. The Contractor shall be authorized by the OEM to pass thru the OEM’s warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the system. This documentation, along with the system Contractor and OEM certifications must be provided in writing as part of the Contractor’s Technical submittal.

C. The Contractor’s Communications Technicians assigned to the system shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the system. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to

the Contracting Officer Technical Representative (COTR) before being allowed to commence work on the system.

D. Applicable national, state and local licenses.

E. Certificate of successful completion of OEM's installation/training school for installing technicians of the equipment being proposed.

1.6 CODES AND PERMITS

A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by the Owner.

B. The Contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

1.7 SCHEDULING

A. After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.

B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The owner will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS

A. Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.

B. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.

C. Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and through equipment list of equipment expected to be installed in the

system, with spares, as a part of the submittal. Special Communications (005OP3B – herein after referred to as 005OP3B) will not review any submittal that does not have this list.

D. Provide four copies to the COTR for technical review. The COTR will provide a copy to the offices identified in Paragraph 1.3.C and D, at a minimum for compliance review as described herein where each responsible individual(s) shall respond to the COTR within 10 days of receipt of their acceptance or rejection of the submittal(s).

1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)

A. Throughout progress of the work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.

B. The floor plans shall be marked in pen to include the following:

1. All device locations with labels.
2. Conduit locations.
3. Head-end equipment and specific location.
4. Wiring diagram.
5. Labeling and administration documentation.
6. Warranty certificate.
7. System test results.

1.10 WARRANTIES AND GUARANTY

A. The Contractor shall warrant the installation to be free from defect in material and workmanship for a period of 1 year from the date of acceptance of the project by the Owner. The Contractor shall agree to remedy covered defects within eight (8) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

B. Refer to Part 4 for applicable System Guarantee requirements.

1.11 USE OF THE SITE

A. Use of the site shall be at the GC’s direction.

B. Coordinate with the GC for lay-down areas for product storage and administration areas.

C. Coordinate work with the GC and their sub-contractors.

D. Access to buildings wherein the work is performed shall be directed by the GC.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.

B. Store products in original containers.

C. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.

D. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

1.13 PROJECT CLOSE-OUT

A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.

B. Before the project closeout date, the Contractor shall submit:

1. Warranty certificate.
2. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
3. Project record documents.
4. Instruction manuals and software that is a part of the system.

C. Contractor shall submit written notice that:

1. Contract Documents have been reviewed.
2. Project has been inspected for compliance with contract.
3. Work has been completed in accordance with the contract

PART 2 – PRODUCTS AND FUNCTIONAL REQUIREMENTS

2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

A. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Expansion Capability: Increase number of stations in the future by 25 percent above those indicated without adding any internal or external components or main trunk cable conductors.

C. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

D. Weather-Resistant Equipment: Listed and labeled by an OSHA certified National Recognized Testing Laboratory (NRTL – i.e. UL) for duty outdoors or in damp locations.

2.2 SYSTEM DESCRIPTION

A. System hardware shall consist of an extension of an existing public address communications network comprised of amplifiers, mixers, speakers, volume controls, test sets, telephone private branch exchange (PBX) interface equipment, equipment cabinets/racks, wiring and other options such as, sub zoning in addition to “all call” functions, computer interfaces, printer interfaces and wireless network interfaces, (when specifically approved by 005OP3B and VA Headquarters Spectrum Management 005OP2B – herein after referred to as 005OP2B) as shown on drawings. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse/patient communications network.

B. Systems firmware shall be the product of a reputable firmware OEM of record with a proven history of product reliability and sole control over all source code. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of twos year from date of acceptance by VA for any product feature enhancements. System configuration programming changes shall not require any exchange of parts and shall be capable of being executed remotely via a modem connection (when specifically approved by 005OP3B).

C. The Public Address System (PAS) Head End Equipment is located in the ADP Closet Room #1147. The PAS shall cover the project scope floor. The PAS shall provide zoned, one-way voice paging through distributed, ceiling mounted loudspeakers. Voice input into the PAS shall be by zone using the telephone system. The Nurse Call/Code Blue System may interface the PAS system when specifically approved by VA Headquarters Spectrum Management 005OP3B during the project approval process prior to contract bidding.

D. The PAS System is defined as an Emergency Communications Systems by NFPA and VA elevates it to Life Safety Communications System when carrying Code Blue signal and so evaluated by JCAHCO. Therefore, the system shall have a minimum of 2 remote enunciation points in order to satisfy NFPA’s Life Safety Code 101.

1. These functions shall be the minimum required of the PAS system:
   a. The Microphone Control Console locations shall be fully manned as long as the Facility is in operation.
   b. One global (aka “all call”) hard wired zone shall be provided that connects to every system speaker.
   c. There shall be one hard-wired sub-zone designated as follows:
      1) Pathology Lab
      2) Each zone shall be capable of be programmed.
      3) The PAS shall have a minimum of 3, unused zones.
2. The PAS shall allow voice pages to be made within a single zone, across programmed multiple zones or a global page (all zones) by using preset codes entered into the keypad of any telephone attached to the PBX.

E. The PAS shall interface with any existing paging system so that a global page (aka “all call” page) is communicated to the existing paging system and the new PAS of this project. Arrangements for interconnection of the PAS and the telephone system(s) shall be coordinated with the owner and the PBX provider.

F. Each PAS system shall be designed to provide continuous electrical supervision of the complete and entire system (i.e. light bulbs, wires, contact switch connections, master control stations, wall stations, circuit boards, data, audio, and communication busses, main and UPS power, etc.). All alarm initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and UPS power circuits shall be supervised for a change in state (i.e. primary to backup, low battery, UPS on line, etc.). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the nurse control station and all remote locations.

G. When the PAS system is approved to connect to a separate communications system (i.e. LAN, WAN, Telephone, Nurse Call, radio raging, wireless systems, etc) the connection point shall meet the following minimum requirements for each hard wired connection (note each wireless system connection must be approved prior to contract bid by VA Headquarters Spectrum Management 005OP3B and 005OP2B):
   1. UL 60950-1/2.
   2. FIPS 142.

3. FCC Part 15 Listed Radio Equipment is not allowed.

H. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities shall be as indicated on the drawings.

2.3 MANUFACTURERS

A. The products specified shall be new, UL Listed, and produced by OEM manufacturer of record.

B. The following equipment items may be required to meet the salient requirements of VA to provide an acceptable system described herein.

2.4 TELEPHONE INTERFACE EQUIPMENT

A. Paging Adaptor:

1. The Contractor shall coordinate the installation of the paging adapter(s) designed for use with the Facility’s telephone system with the Facility Telephone Contractor or local telephone company.
2. The Contractor shall provide and install a paging adapter(s) for each zone and sub zone. The paging adapter(s) shall be accessible by dialing a telephone number provided by the Facility’s Telephone Contractor. The Paging Adapter shall:
   a. Monitor each audio input and output on the unit.
   b. Be provided with an electrical supervision panel to provide both audio and visual trouble alarms.
   c. Be provided as part of the Head End equipment and shall be located in the Telephone Switch Room.
   d. Be provide with Executive Paging Override of all routine paging calls in progress or being accessed to allow system “all call” (aka global) and radio paging calls designated as C**ODE ONE** Blue) functions.
   e. Be capable of internal time out capability.
   f. Function completely with the interface module.

B. Time Out Device:

1. A time out device/capability shall be provided to prevent system “hang-up” due to an off-hook telephone. The device shall be able to be preset from 30 seconds to 2 minutes. Its function shall not interfere with or override the required “all call” (aka global) operational capability.
2. Audio Monitor Panel:

a. The panel shall be EIA/TIA standard for 483 mm (19”) cabinet mounting.
b. It shall be provided in the upper portion of the head-end equipment cabinet

C. Interface Module:
1. Universal telephone port interface with input for background music.
2. Gain control for telephone and background music inputs.
3. Emergency page override.

D. Microphone Paging Console:
1. The microphone paging console is existing.
2. The console shall contain visual enunciators for each connection to the telephone system’s Public Address Paging Adapter. The visual enunciators shall display all the system connections to the telephone system being used.
3. The console shall be fully independent of the facility’s telephone system so if the telephone system has a catastrophic failure (aka partial, multiple or total system failure) the microphone console will function normally as if the facility’s telephone system was operating normally. The restoration of the facility’s telephone system shall not affect the PAS.
4. Each microphone console shall:
a. Be Mounted: Flush unless otherwise indicated, and suitable for mounting conditions indicated.
b. Have a Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.
c. Have a system interface Back Box: Two-gang galvanized steel with 2-1/2-inch minimum depth.
d. Have an Internal Speaker: 3 inches, 2.3 oz. minimum; permanent magnet.
e. Have Tone Annunciation: Recurring momentary tone indicates incoming calls.
f. Have a Call Switch: Mount on faceplate. Permits calls to master station.
g. Have a Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.

h. Have a Handset with Hook Switch: Telephone type with 24-inch long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

i. Monitor each audio input and output on the unit.

j. Be provided with an electrical supervision panel to provide both audio and visual trouble alarms to the Nurse Call /Code Blue electrical supervision system.

k. Be capable of internal time out capability.

l. Be completely compatible with the Telephone Interface unit(s).

E. Central Processor Module:

1. Controls system operations and holds all programmed parameters.
2. Data link connection to additional CPU modules.

F. Zone Module:

1. Provides paging zone outputs at 70V.
2. Background Music inhibit switch for each zone.

G. Power Module: Provides 12V DC @ 800mA to Central Processor Module.

H. Rack mounting: Provide rack mount kit.

2.5 HEAD-END EQUIPMENT

A. Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system listed in Paragraph 2.3. Head-end components may be rack mounted or wall mounted in a metal enclosure.

B. Provide the head end equipment in the closed telecommunications closet where the PAS system is installed to include the minimum equipment listed in Paragraph 2.3.

C. Provide minimum of 15 minute battery back-up to system components.

D. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions

E. Vertical Equipment Rack, Wall Mounted (to be included inside of the Equipment Cabinet):

1. 74” (48RU) rack space. Welded Steel construction. Minimum 20” usable depth. Adjustable front mounting rails.
2. Install the following products in rack provided by same manufacturer or as specified:

a. Security screws w/ nylon isolation bushings.

b. Textured blank panels.

c. Custom mounts for components without rack mount kits.

d. Security covers.

e. Copper Bus Bar.

f. Power Sequencer- rack-mounted power conditioner and (provide as-needed) delayed sequencer(s) with two unswitched outlets each and contact closure control inputs.

2.6 AMPLIFIER EQUIPMENT (IF REQUIRED)

A. Paging:

1. Inputs for 600-ohm balanced telephone line, LO-Z balanced microphone, and background music.
2. Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters
3. Automatic Level Control (ALC) for pages, adjustable background music muting level during, page, wall or rack mountable.
4. 16-ohm, 25V, 25V center tapped (CT), and 70V outputs. Amplifier quantity and size (output power) as needed. Continuous amplifier power rating shall exceed loudspeaker load on amplifier by at least 25 percent.
5. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
6. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
7. Minimum Signal-to-Noise Ratio: 45 dB, at rated output.
8. Frequency Response: Within plus or minus 3 dB from 70 to 12,000 Hz.
9. Output Regulation: Maintains output level within 2 dB from full to no load.
10. Amplifier Protection: Prevents damage from shorted or open output.
11. Be provided with electronic supervision function(s).
12. Provide one spare amplifier.

B. Distributed:

1. Refer to the Head End Amplifier characteristics in paragraph 2.4.A. for each amplifier used in the distribution system.

2. Provide one spare amplifier in addition to the spare Head End amplifier.

2.7 SYSTEM SPEAKERS

A. Ceiling Cone-Type:

1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
2. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.
3. Minimum Dispersion Angle: 100 degrees.
4. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
5. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.
6. Baffle: For flush speakers, minimum thickness of 0.032-inch aluminum with textured white finish. Completely fill the baffle with fiberglass.
7. Vandal-Proof, High-Strength Baffle: For flush-mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi, 0.025-inch minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
8. Size: 8 inches with 1-inch voice coil and minimum 5-oz. ceramic magnet.
9. Have a minimum of 2 safety wires installed to a solid surface or use a flexible conduit from ceiling/wall back box to the speaker back box.
10. The speakers and mounting shall be self contained and wall mounted with flush back box at a minimum of 10 meter intervals and shall match (or contrast with, at the direction of the Resident Engineer) the color of the adjacent surfaces.
11. Provide one spare speaker, mount, and back box for each 50 speakers or portion thereof.

B. Wall Mounted Horn-Type:

1. Each horn speaker shall be provided with a means of adjusting the output level over the rated horn speaker range to an appropriate audio level in the area installed.

2. Provide horn speakers in equipment rooms, mechanical room, and at other areas as indicated on the drawings.
3. Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.
4. Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.
5. Minimum Power Rating of Driver: 15 W, continuous.
6. Minimum Dispersion Angle: 110 degrees.
7. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
8. Provide one spare speaker, mount, and back box for each 20 speakers or portion thereof.

2.8 SYSTEM CABLES

A. Refer to OFM approved Construction Specification 27 10 00, STRUCTURED CABLING for specific installation and testing requirements.

B. Line Level Audio and Microphone Cable:
   1. Line level audio and microphone cable for inside racks and conduit.
   2. Shielded, twisted pair Minimum 22AWG, stranded conductors and 24AWG drain wire with overall jacket.

C. Speaker Level Audio Cable (70v):
   1. For use with 70-volt speaker circuits.
   2. 18AWG stranded pair, minimum.

D. Speaker Level Audio Cable, Plenum Rated (70v):
   1. For use with 70-volt speaker circuits.
   2. 18AWG stranded pair, minimum.

E. All cabling shall be plenum rated.

F. Provide 1 spare 1,000 foot roll of approved system (not microphone) cable only.

2.9 RACEWAYS

A. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 16 Section "Raceway and Boxes for Electrical Systems."

B. Each raceway that is open top, shall be: UL certified for telecommunications systems, partitioned with metal partitions in order to comply with NEC Parts 517 and 800 to “mechanically separate telecommunications systems of different service, protect the installed cables from falling out when vertically mounted and allow junction

boxes to be attached to the side to interface “drop” type conduit cable feeds.

C. Intercommunication System cable infrastructure: EMT or in J-hooks above accessible ceilings, 24 inches on center.

D. Junction boxes shall be not less than 2-1/2 inches deep and 6 inches wide by 6 inches long.

E. Flexible metal conduit is prohibited unless specifically approved by 005OP3B.

2.10 CONDUIT SLEEVES

A. The Engineer has made a good effort to identify where conduit sleeves through full-height and fire rated walls on the drawings, and has instructed the Electrician to provide the sleeves as shown on the drawings.

B. While the sleeves shown on the drawings will be provided by others, the contractor is responsible for installing conduit sleeves and fireproofing where necessary. It is often the case, that due to field conditions, the nurse-call cable may have to be installed through an alternate route. Any conduit sleeves required due to field conditions or those omitted by the Engineer shall be provided by the cabling contractor.

2.11 UNINTERRUPTIBLE POWER SUPPLY (UPS)(IF REQUIRED)

A. Provide a backup battery or a UPS for the system to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 15 minutes.

B. As an alternate solution, the telephone system UPS may be utilized to meet this requirement at the Head End location, as long as this function is specifically approved by the Telephone Contractor and the COTR.

C. The PA Contractor shall not make any attachments or connection to the telephone system until specifically directed to do so, in writing, by the COTR.

D. Provide UPS for all active system components including but not limited to:

1. System Amplifiers.
2. Microphone Consoles.
3. Telephone Interface Units.

4. PBX and Head End Equipment Rack(s.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

A. Assign a single project manager to this project who will serve as the point of contact for the Owner, the General Contractor, and the Engineer.

B. The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the General Contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.

C. Contact the Office of Telecommunications, Special Communications Team (005OP3B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA’s Spectrum Management and OCIS Teams.

3.2 COORDINATION WITH OTHER TRADES

A. Coordinate with the cabling contractor the location of the faceplate and the faceplate opening for the MATV backbox.

B. Coordinate with the cabling contractor the location of MATV equipment in the Telecommunications Closets.

C. Before beginning work, verify the location, quantity, size and access for the following:

Isolated ground AC power circuits provided for systems.

Primary, emergency and extra auxiliary AC power generator requirements.

Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.

System components installed by others.

Overhead supports and rigging hardware installed by others.

D. Immediately notify the Owner, General Contractor and Consultant in writing of any discrepancies.

3.3 INSTALLATION

A. General:

1. Execute work in accordance with National, State and local codes, regulations and ordinances.
2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor

will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.

3. Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
4. Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc:
   a. All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.
   b. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.
   c. Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.
   d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.
5. Locate overhead ceiling-mounted loudspeakers as shown on drawings, with minor changes not to exceed 12" in any direction:
   a. Mount transformers securely to speaker brackets or enclosures using screws. Adjust torsion springs as needed to securely support speaker assembly.
   b. Speaker back boxes shall be completely filled with fiberglass insulation.
   c. Seal cone speakers to their enclosures to prevent air passing from one side of the speaker to the other.
6. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Owner and 005OP3B.
7. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommeted holes in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.

B. Equipment Racks:
   1. Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks.

2. Provide security covers for all devices not requiring routine operator control.
3. Provide vent panels and cooling fans as required for the operation of equipment within the OEM' specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow manufacturer’s recommendations regarding ventilation space between amplifiers.
4. Provide insulated connections of the electrical raceway to equipment racks.
5. Provide continuous raceway/conduit with no more than 40 percent fill between wire troughs and equipment racks for all non-plenum-rated cable. Ensure each system is mechanically separated from each other in the wireway.

C. Wiring Practice: In addition to the mandatory infrastructure requirements outlined in VA Construction Specification, Section 27 10 00, STRUCTURED CABLING, the following additional practices shall be adhered to:

1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
3. Wiring shall be classified according to the following low voltage signal types:
   a. Balanced microphone level audio (below -20dBm) or Balanced line level audio (-20dBm to +30dBm)
   b. 70V loudspeaker level audio.
   c. Low voltage DC control or power (less than 48VDC)
4. Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share the same enclosure shall be mechanically partitioned and separated by at least four inches. Where Wiring of differing classifications must cross, they shall cross perpendicular to one another.

5. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.
6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.
7. Replace the entire length of the run of any wire or cable that is damaged or abraided during installation. There are no acceptable methods of repairing damaged or abraided wiring.
8. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
9. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
10. Do not use tape-based or glue-based cable anchors.
11. Ground shields and drain wires as indicated by the drawings.
12. Field wiring entering equipment racks shall be terminated as follows:
    a. Provide ample service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.
    b. Line level and speaker level wiring may be terminated inside the equipment rack using specified terminal blocks (see “Products”). Provide 15 percent spare terminals inside each rack. Microphone level wiring may only be terminated at the equipment served.
    c. If specified terminal blocks are not designed for rack mounting, utilize 3/4″ plywood or 1/8″ thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.
    d. Employ permanent strain relief for any cable with an outside diameter of 1″ or greater.
13. Use only balanced audio circuits unless noted otherwise
14. Make all connections as follows:
    a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.
    b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.

c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.

d. Wire nuts, electrical tape or “Scotch Lock” connections are not acceptable for any application.

D. Cable Installation: In addition to the mandatory infrastructure requirements outlined in VA Construction Specification, Section 27 10 00, STRUCTURED CABLING, the following additional practices shall be adhered to:

1. Support cable on maximum 4’-0” centers. Acceptable means of cable support are cable tray, j-hooks, and bridal rings. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.
2. Run cables parallel to walls.
3. Install maximum of 10 cables in a single row of J-hooks. Provide necessary rows of J-hooks as required by the number of cables.
4. Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2’-0” clearance from all shielded electrical apparatus.
5. All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the Owner.
6. Ends of cables shall be properly terminated on both ends per industry and OEM’s recommendations.
7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.
8. Cover the end of the overall jacket with a 1” (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2” (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2” (minimum) past the Heat-shrink and serve as indicated below.

9. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing ¼″ past the end of unused wires, fold back over jacket and secure with cable tie.
10. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.
11. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
12. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
13. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
14. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
15. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
16. Separation of Wires: (REFER TO RACEWAY INSTALLATION) Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
17. Serve all cables as follows:
    a. Cover the end of the overall jacket with a 1″ (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2″ (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield and drain wires 2″ (minimum) past the Heat-shrink and serve as indicated below.
    b. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing ¼″ past the end of unused wires, fold back over jacket and secure with cable tie.
    c. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.

E. Labeling:

1. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
2. Engrave and paint fill all receptacle panels using 1/8” (minimum) high lettering and contrasting paint.
3. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8” (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.
4. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
5. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
6. Contractor’s name shall appear no more than once on each continuous set of racks. The Contractor’s name shall not appear on wall plates or portable equipment.
7. Ensure each OEM supplied equipment has appropriate UL Labels/Marks for the service the equipment is performed permanently attached/marked. Equipment installed not bearing these UL marks will not be allowed to be part of the system. The Contractor shall bear all costs required to provide replacement equipment with approved UL marks.

3.4 PROTECTION OF NETWORK DEVICES

Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician come in contact with high voltage.

3.5 CLEANING AND PATCHING

A. It shall be the responsibility of the Contractor to keep their work area clear of debris and clean area daily at completion of work.

B. It shall be the responsibility of the Contractor to patch and paint any wall or surface that has been disturbed by the execution of this work.

C. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the work or to make its parts fit together properly.

D. The Contractor shall not damage or endanger a portion of the work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor, the Contractor’s consent to cutting or otherwise altering the work.

E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the location shall be approved by the COTR prior to commencement of coring work.

3.6 FIREPROOFING

A. Where MATV cables penetrate fire rated walls, floors and ceilings, fireproof the opening.

B. Provide conduit sleeves (if not already provided by Electrical Contractor) for cables that penetrate fire rated walls. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.

C. Use only materials and methods that preserve the integrity of the fire stopping system and its rating.

3.7 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Division 26, Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

D. Do not use “3rd or 4th” wire internal electrical system conductors for ground.

E. Do not connect system ground to the building’s external lightning protection system.

F. Do not “mix grounds” of different systems.

PART 4 - TESTING/GUARANTY/TRAINING

4.1 SYSTEM CLASSIFICATION

The PAS System is NFPA listed as an “Emergency and Public Safety” Communications system. Where Code Blue signals are transmitted, that listing is elevated to “Life Support.” Therefore, the following testing and guaranty provisions are the minimum to be performed and provided by the Contractor and OEM.

4.2 PROOF OF PERFORMANCE TESTING

A. Intermediate Testing:

1. After completion of 25 – 30 percent the installation of a head end cabinet(s) and equipment, one microphone console, local and remote enunciation stations, 2 zones, 2 sub zones prior to any further work, this portion of the system must be pre-tested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed, NFPA, Life Safety, and JCAHCO guidelines are followed, and proper installation practices are followed. The intermediate test shall include a full operational test.
2. The inspection and test will be conducted by a factory-certified representative and witnessed by a Government Representative. The results of the inspection will be officially recorded by the Government Representative and maintained on file by the COTR until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75 percent of the system construction phase, at the direction of the COTR.

B. Pretesting:

1. Upon completing installation of the PAS System, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.

2. Pretesting Procedure:
   a. During the system pretest the Contractor shall verify (utilizing approved test equipment) that the system is fully operational and meets all the system performance requirements of this standard.
   b. The Contractor shall pretest and verify that all system functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc., are present. At a minimum, each of the following locations shall be fully pre-tested:
      1) Central Control Cabinets.
      2) PA Control Stations.
      3) Zone Equipment/Systems.
      4) Sub-Zone Equipment/Systems.
      5) Local and Remote Enunciation Panels.
      6) All Networked locations.
      7) System interface locations (i.e. TELCO, two way radio, etc.).
      8) System trouble reporting.
      9) System Electrical Supervision.
      10) UPS operation.
3. The Contractor shall provide four copies of the recorded system pretest measurements and the written certification that the system is ready for the formal acceptance test shall be submitted to the COTR.

C. Acceptance Test:
1. After the system has been pre-tested and the Contractor has submitted the pretest results and certification to the COTR, then the Contractor shall schedule an acceptance test date and give the COTR (30) days written notice prior to the date the acceptance test is expected to begin. The system shall be tested in the presence of a Government Representative and an OEM certified representative. The system shall be tested utilizing the approved test equipment to certify proof of performance and Emergency and Public Safety compliance. The test shall verify that the total system meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed system does comply with all requirements of this specification under operating conditions. The system shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the system that precludes completion of system testing, and which cannot be repaired in 4 hours, shall be cause for terminating the acceptance test of the system. Repeated failures that result in a cumulative time of 8 hours to affect repairs shall cause the entire system to be declared unacceptable. Retesting of the entire system shall be rescheduled at the convenience of the Government.

D. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:
   a. The VACO Government Representative will tour all major areas where the system is and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
   b. The system diagrams, record drawings, equipment manuals, Telecommunications Infrastructure Plant (TIP) Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.
   c. Failure of the system to meet the installation requirements of this specification shall be grounds for terminating all testing.
2. Operational Test:
   a. After the Physical and Mechanical Inspection, the central terminating and nurse call master control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter may be utilized to accomplish this requirement.
   b. Following the central equipment test, a pillow speaker (or on board speaker) shall be connected to the central terminating and nurse call master control equipment’s output tap to ensure there

are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.

c. The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last intersectional, room, and bed dome light in each leg to verify that the nurse call distribution system meets all system performance standards.

d. Each MATV outlet that is controlled by a nurse call pillow speaker shall be functionally tested at the same time utilizing the Contractor’s approved hospital grade TV receiver and TV remote control cable.

e. The red system and volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the red system (if installed).

f. Additionally, each installed head end equipment, microphone console, amplifier, mixer, distributed speaker/amplifier, monitor speaker, telephone interface, power supply and remote amplifiers shall be checked insuring they meet the requirements of this specification.

g. Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system. The typical functions are: “all call,” three sub-zoned, minimum of 10 minutes of UPS operation, electrical supervision, trouble panel, corridor speakers and audio paging.

h. Individual Item Test: The Government Representative will select individual items of equipment for detailed proof of performance testing until 100 percent of the system has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.

3. Test Conclusion:

a. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the COTR. Any retesting to comply with these specifications will be done at the Contractor's expense.

b. If the system is declared unacceptable without conditions, all rescheduled testing expenses will be born by the Contractor.

E. Acceptable Test Equipment

1. The test equipment shall furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
   a. Spectrum Analyzer.
   b. Signal Level Meter.
   c. Volt-Ohm Meter.
   d. Sound Pressure Level (SPL) Meter.
   e. Oscilloscope.
   f. Random Noise Generator.
   g. Audio Amplifier with External Speaker.

4.3 SYSTEM GUARANTEE PERIOD OF SERVICE

A. Contractor’s Responsibility:

1. The Contractor shall guarantee that all provided material and equipment will be free from defects, workmanship and will remain so for a period of one year from date of final acceptance of the system by the VA. The Contractor shall provide OEM’s equipment warranty documents, to the COTR that certifies each item of equipment installed conforms to OEM published specifications.
2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
3. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide 2 copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the two year guarantee period:
   a. Response Time during the Two Year Guarantee Period:

1) The COTR is the Contractor's only official reporting and contact official for MATV system trouble calls, during the guarantee period.
2) A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the COTR, Monday through Friday exclusive of Federal Holidays.
3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
   a) A routine trouble call within 1 working day of its report. A routine trouble is considered a trouble which causes a pillow speaker or cordset, 1 master IC control station, room station or emergency station to be inoperable.
   b) Routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as an emergency trouble call. The COTR shall notify the Contractor of this type of trouble call.
   c) An emergency trouble call within 4 hours of its report. An emergency trouble is considered a trouble which causes a sub-system (ward), distribution point, terminal cabinet, or all call system to be inoperable at anytime.
4) If a PAS component failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate nurse call equipment. The alternate equipment/system shall be operational within a maximum of 20 hours after the four hour trouble shooting time and restore the effected location operation to meet the system performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment returning the system or sub-system to full operational capability, as described herein, until repairs are complete.

b. Required On-Site Visits during the Two Year Guaranty Period
   1) The Contractor shall visit, on-site, as necessary, during the guarantee period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain

the system according the descriptions identified in this document.

2) The Contractor shall arrange all Facility visits with the COTR prior to performing the required maintenance visits.
3) Preventive maintenance shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the COTR and Contractor.
4) The preventive maintenance schedule, functions and reports shall be provided to and approved by the COTR.
5) The Contractor shall provide the COTR a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the COTR with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
   a) The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to COTR by the fifth (5th) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
   b) The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the system. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
6) The COTR shall convey to the Facility Engineering Officer, 2 copies of actual reports for evaluation.
   a) The COTR shall ensure a copy of these reports is entered into the system’s official acquisition documents.

b) The Facility Chief Engineer shall ensure a copy of these reports is entered into the system's official technical record documents.

B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, Contractor, or Owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the COTR in writing upon the discovery of these incidents. The COTR will investigate all reported incidents and render his decision.

4.4 TRAINING

A. Provide thorough training of the Owner's engineering and maintenance staff.

B. Provide the following minimum training times and durations:

1. 24 hours prior to opening

- - - E N D - - -

SECTION 27 52 31
SECURITY EMERGENCY CALL, DURESS ALARM, AND TELECOMMUNICATIONS - EXTENSION

PART 1 - GENERAL

1.1 SECTION SUMMARY

A. Work covered by this document includes design, engineering, labor, material, products, guaranty, training and services for, and incidental to, the complete installation of a new extension of the existing fully operating National Fire Protection Association (NFPA) Listed Critical Service Nurse-Call and Life Safety Code Blue communication system as detailed herein.

B. Work shall be complete, tested, labeled, certified and ready for operation.

1.2 RELATED SECTIONS

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 Volts and Below).

C. Section 27 05 11, REQUIREMENTS FOR COMMUNCATIONS INSTALLATIONS.

D. Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.

1.3 DEFINITIONS

A. Provide: Design, engineer, furnish, install, connect complete, test, certify and guarantee.

B. Work: Materials furnished and completely installed.

C. Review of contract drawings: A service by the Engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The Engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.

D. Headquarters (aka VACO) Technical Review, for National and VA Communications and Security, Codes, Frequency Licensing Standards, Guidelines and Compliance:

Office of Telecommunications
Special Communications Team (005OP3B)
1335 East West Highway – 3rd Floor
Silver Spring, Maryland 20910,
(O) 301-734-0350, (F) 301-734-0360

E. Engineer: van Zelm, Heywood and Shadford, Inc.
10 Talcott Notch Road
Farmington, CT
(860) 284-5064

F. Owner: West Haven VA Medical Center

1.4 REFERENCES

A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:

1. United States:
   a. Department of Commerce:
      1) National Telecommunications and Information Administration (NTIA), Red Book, Chapter 7.8/9 Radio Frequency Restriction of Use and Compliance.
      2) National Institute of Standards Technology (NIST), Federal Information Processing Standards Publication (FIPS) 140-2, Security Requirements for Cryptographic Modules.
   b. Department of Labor, Occupational Safety and Health Administration (OSHA): All standards for personnel physical and life safety.
   c. Department of Veterans Affairs, Office of Cyber and Information Security (OCIS):
      1) Handbook 6500, Information Security Program.
      2) Spectrum Management Radio Frequency Compliance and Licensing Program.
      3) Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
   d. Federal Communications Commission (FCC): Part 15, Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/Locations.
2. American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA):

568-B	Commercial Building Telecommunications Wiring Standards:
569	Commercial Building Standard for Telecommunications Pathways and Spaces.

606	Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
607	Commercial Building Grounding and Bonding Requirements for Telecommunications.
REC 127-49	Power Supplies.
RS 27	Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.

3. Institute of Electrical and Electronics Engineers (IEEE):

SO/TR 21730:2007	Use of mobile wireless communication and computing technology in healthcare facilities - Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.
0739-5175/08/$25.00 ©2008IEEE	Medical Grade – Mission Critical – Wireless Networks.
C62.41	Surge Voltages in Low-Voltage AC Power Circuits.

4. Joint Commission on Accreditation of Healthcare Organizations (JCAHO): All guidelines for Life and Public Safety and Emergency Communications.

5. NFPA:

70	National Electrical Code (current date of issue) – Articles 517, 645 and 800.
75	Standard for Protection of Electronic Computer Data- Processing Equipment.
77	Recommended Practice on Static Electricity.
99	Healthcare Facilities.
101	Life Safety Code.

6. Underwriters Laboratories (UL):

65	Standard for Wired Cabinets.
468	Standard for Grounding and Bonding Equipment.
1449	Standard for Transient Voltage Surge Suppressors.
1069	Hospital Signaling and Nurse Call Equipment.
60950-1/2	Information Technology Equipment – Safety.

7. State Hospital Code(s).
8. Local Codes.

1.5 QUALIFICATIONS

A. The OEM shall have had experience with three or more installations of Public Address Systems of comparable size and complexity concerning type and design as specified herein. Each of these installations shall have performed satisfactorily for at least 1 year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.

B. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of 3 years. The Contractor shall be authorized by the OEM to pass thru the OEM’s warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the system. This documentation, along with the system

Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.

C. The Contractor's Communications Technicians assigned to the system shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the system. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the Contracting Offices Technical Representative (COTR) before being allowed to commence work on the system.

D. Applicable national, state and local licenses.

E. Certificate of successful completion of OEM's installation/training school for installing technicians of the equipment being proposed.

1.6 CODES AND PERMITS

Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by the Owner.

1.7 SCHEDULING

A. After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.

B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The owner will not be liable for any additional costs due to missed dates or poor coordination of the supplying Contractor with other trades.

1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS

Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.

B. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the

manufacturer. These materials shall show conformance to specification and drawing requirements.

C. Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and through equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special Communications (005OP3B – herein after referred to as 005OP3B) will not review any submittal that does not have this list.

D. Provide four copies to the COTR for technical review. The COTR will provide a copy to the offices identified in Paragraph 1.3.C and D, at a minimum for compliance review as described herein where each responsible individual(s) should respond to the COTR within 10 days of receipt of their acceptance or rejection of the submittal(s).

1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)

A. Throughout progress of the work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.

B. The floor plans shall be marked in pen to include the following:

1. All device locations with labels.
2. Conduit locations.
3. Head-end equipment and specific location.
4. Wiring diagram.
5. Labeling and administration documentation.
6. Warranty certificate.
7. System test results.

1.10 WARRANTIES/GUARANTY

A. The Contractor shall warrant the installation to be free from defect in material and workmanship for a period of 1 year from the date of acceptance of the project by the Owner. The Contractor shall agree to remedy covered defects within 8 hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

B. Refer to Part 4 for applicable System Guarantee requirements.

1.11 USE OF THE SITE

A. Use of the site shall be at the GC’s direction.

B. Coordinate with the GC for lay-down areas for product storage and administration areas.

C. Coordinate work with the GC and their sub-Contractors.

D. Access to buildings wherein the work is performed shall be directed by the GC.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.

B. Store products in original containers.

C. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.

D. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

1.13 PROJECT CLOSEOUT

A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.

B. Before the project closeout date, the Contractor shall submit:

1. Warranty certificate.
2. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
3. Project record documents.
4. Instruction manuals and software that is a part of the system.

C. Contractor shall submit written notice that:

1. Contract Documents have been reviewed.
2. Project has been inspected for compliance with contract.
3. Work has been completed in accordance with the contract documents.

PART 2 - PRODUCTS AND FUNCTIONAL REQUIREMENTS

2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

A. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Expansion Capability: Increase number of stations in the future by 25 percent above those indicated without adding any internal or external components or main trunk cable conductors.

C. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

D. Weather-Resistant Equipment: Listed and labeled by an OSHA certified National Recognized Testing Laboratory (NRTL – i.e. UL) for duty outdoors or in damp locations.

2.2 SYSTEM DESCRIPTION

A. System hardware shall consist of an indoor or outdoor enclosures, poles, strobe lights, intercom system, intercom stations, intercom master stations, and power supplies. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse and patient communications network.

B. Systems firmware shall be the product of a reputable firmware OEM of record with a proven history of product reliability and sole control over all source code. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of two year from date of acceptance by VA for any product feature enhancements. System configuration programming changes shall not require any exchange of parts and shall be capable of being executed remotely via a modem connection (when specifically approved by 005OP2B).

2.3 EMERGENCY CALL STATIONS

A. The emergency call station shall be a dual button emergency phone. The unit shall be an ADA compliant, multi-function, high strength, vandal resistant security unit. The unit shall include a high quality, vandal resistant, hands free communications device, a powerful (1 million candlepower) strobe light and a vivid blue area light, which serves to identify the unit from great distances. The unit shall include an integrated wall mount enclosure assembly and an emergency phone station.

B. The unit shall have an integrated blue light and strobe encased in Lexan. The blue light shall be always lit, calling attention to the location of the emergency communication unit. When the emergency phone is activated, the strobe shall flash at 1 million candlepower and 60 fpm. The strobe shall flash until either actively terminated by the personnel receiving the call or automatically upon termination of the call itself.

C. The wall mount enclosure shall be made of a vandal resistant, 12-gauge No.4 vertical brushed stainless steel. It shall be designed to withstand prolonged exposure to harsh environments. The unit shall have a blue light/strobe located at the top of the unit, housed in a vandal resistant, blue polycarbonate refractor housing. This blue light and strobe shall be further enclosed in a clear polycarbonate security enclosure. The wall mount shall measure 12 1/8 inches w x 32 1/4 inches h x 7 9/16 inches d and weigh approximately 75 lbs. The ADA-compliant, hands-free emergency phone shall be flush mounted into the wall mount enclosure. Emergency phone station faceplate shall be 12-gauge No.4 brushed stainless steel or as otherwise approved.

D. The housing for pole mount unit shall be a concentric steel cylinder (bollard) with an 8.75 inch diameter, a .25 inch wall thickness and a height of 84 inches. The unit shall have a blue light and strode located at the top of the unit. A deep blue polycarbonate prismatic refractor that distributes the light in a horizontal pattern, making the flash bright and visible even at great distances, shall cover the strobe. The ADA-compliant, hands-free emergency phone shall be flush mounted into the pole mount housing. The unit weight approximately 275 lbs.

E. The blue light and strobe shall be controlled via the emergency phone, and connect to an auxiliary output of the emergency phone. The emergency phone shall connect via its RJ-11 connector to a standard phone line or PBX extension. The emergency phone should not require connection to any power source other than the telephone line. The blue light, strobe, and faceplate light require 24VAC, 60Hz power.

F. The unit shall have the following features:
   1. Interface with Owner’s PBX or regular phone line.
   2. Vandal resistant stainless steel faceplate and metal button(s).
   3. Phone line powered; no power supply or battery backup required.
   4. LED indicator for hearing impaired.
   5. Cast metal raised letter and Braille signage for ADA compliance.
   6. Auto-answer that allows security to monitor and initiate calls with Owner provided phone.
   7. Auxiliary input and outputs programmable to integrate with CCTV and security systems.

G. Tamper resistant fasteners shall be used. It shall not be possible to enter the unit or remove any component without a special computer designed bit-wrench designed for the purpose. These bit-wrenches are available only from the manufacturer of the unit. All other types of fasteners shall not be acceptable due to the abundance of non-proprietary tools available for their removal.

H. The entire unit shall be water and insect resistant when fully assembled.

I. The system shall immediately and automatically dial the security desk when activated. In addition, activation shall simultaneously cause the blue strobe light to flash at no less than 60 times per minute and where indicated activate CCTV camera switching via an interface to the CCTV system and the access control system.

J. Mounting:

1. Wall mount security call stations shall be attached to the wall with anchors bolts as recommended by the manufacturer or otherwise indicated herein.
2. Security call station poles shall be secured as shown on the drawings.

K. Electrical:

1. All electrical components shall have quick-disconnect terminals with plug and receptacle attachments for easy service or removal. All wiring shall be concealed within the unit and shall not be visible from the outside.
2. The unit shall require 24 VAC under normal operation. The entire unit shall be surge protected.

L. Strobe Lights:

1. The strobe light shall generate approximately 1,000,000 candlepower, and have a flash rate of no less than 60 flashes per minute. It shall be covered by a deep blue polycarbonate, prismatic refractor that distributes the light in a horizontal pattern, making the flash bright and visible even at great distances. The strobe light shall be situated within the housing, inaccessible to vandals and weather resistant.
2. The strobe shall be automatically activated when the "Emergency" button is touched, and shall flash until the receiving party of the

call deactivates it. The strobe cannot be deactivated at the unit itself.

M. Communications:

1. Each unit shall have a high quality, vandal resistant and ADA compliant communications device.
2. The speakerphone shall have the following standard features:
   a. Three number dialing capability.
   b. Programmable from a remote location.
   c. Two input relays.
   d. Two output relays.
   e. Remote speaker volume adjustment.
   f. Capable of playing up to two digitally stored voice messages.
   g. Programmable passwords.
   h. Capable of using interchangeable faceplates.
   i. Silent dial out.
   j. Output sound level >80 dB at 1 meter for normal conversation.
   k. Waterproof speaker.
   l. Waterproof microphone.
   m. Auto answer and auto shut-off.
   n. Operating temperatures of -40°F to +150°F (-40° to +65°C).
   o. Speakerphone electronics are conformal coated to withstand harsh environments.

N. Graphics:

1. The graphics shall be cut from an engineering grade reflective vinyl for high visibility and legibility, with a seven-year durability.
2. The standard graphics text shall be “Emergency”. Standard colors shall be reflective white, reflective blue and reflective black.

O. Finish:

1. For wall mounted unit, the finish shall be stainless steel. The finish shall be uniform and free of visible defects.
2. For pole mounted unit, the unit shall be finished with a coating process known to be highly graffiti resistant and UV resistant.

P. Security Call Station Power Supply:

1. Security Call Station power supply shall power multiple call stations.
2. Power supply shall include the following:
   a. Steel, NEMA 1 rated enclosure.

b. AC power indicator with power On/Off switch.
c. 120 or 230 VAC selectable input.
d. 24VAC output or 28VAC output for longer runs.
e. Main fused input.
f. 10A current capacity.
g. 8 fused outputs.
h. Input wire size 12-16 gauge.
i. Output wire size 12-22 gauge solid or stranded wire.

Q. Security Call Station Cable
1. Call Station communication cable shall meet manufacturers' requirement.
2. Call Station power cable shall be minimum 14 awg wire or as otherwise approved. Power cable for each call station shall be home run from the power supply to the respective call station unit.
3. Cables installed underground or in underground conduits must be rated for direct burial installation.
4. Cables used inside a building must be labeled for indoor use as described in NFPA 70, the National Electric Code. Cables shall be plenum rated if used in a plenum space and riser rated in all other areas.

2.4 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Provide a backup battery or a UPS for the system to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 15 minutes.
B. As an alternate solution, the telephone system UPS may be utilized to meet this requirement at the head-end location, as long as this function is specifically approved by the Telephone Contractor and the COTR.
C. The Contractor shall not make any attachments or connection to the telephone system until specifically directed to do so, in writing, by the COTR.
D. Provide UPS for all active system components including but not limited to:
1. Intercom head-end
2. Master intercom stations
3. Remoted intercom stations

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

A. Assign a single project manager to this project who will serve as the point of contact for the Owner, the General Contractor, and the Engineer.

B. The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the General Contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.

C. Contact the Office of Telecommunications, Special Communications Team (005OP3B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA’s Spectrum Management and OCIS Teams.

3.2 COORDINATION WITH OTHER TRADES

A. Coordinate with the cabling contractor the location of security emergency call and duress alarm equipment in the Telecommunications Closets.

B. Before beginning work, verify the location, quantity, size and access for the following:

1. Isolated ground AC power circuits provided for systems.
2. Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
3. System components installed by others.
4. Overhead supports and rigging hardware installed by others.

C. Immediately notify the Owner, General Contractor and Engineer in writing of any discrepancies.

3.3 INSTALLATION

A. General:

1. Execute work in accordance with National, State and local codes, regulations and ordinances.
2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.

3. Install equipment according to OEM’s recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
4. Secure equipment firmly in place, including intercom stations, equipment racks, system cables, etc.
   a. All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.
   b. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.
   c. Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.
   d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.
5. Finishes for any exposed work such as plates, racks, panels, towers, enclosures, intercom stations, etc. shall be approved by the Architect, Owner and 005OP3B.
6. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommeted holes in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.

B. Equipment Racks:
1. Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks.
2. Provide security covers for all devices not requiring routine operator control.
3. Provide vent panels and cooling fans as required for the operation of equipment within the OEM' specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow manufacturer’s recommendations regarding ventilation space between amplifiers.
4. Provide insulated connections of the electrical raceway to equipment racks.
5. Provide continuous raceway and conduit with no more than 40 percent fill between wire troughs and equipment racks for all non-plenum-

rated cable. Ensure each system is mechanically separated from each other in the wireway.

C. Wiring Practice:

1. Comply with requirements for raceways and boxes specified in Division 26, Section 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
3. Wiring shall be classified according to the following low voltage signal types:
   a. Voice audio
   b. Low voltage DC control or power (less than 48VDC).
4. Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share the same enclosure shall be mechanically partitioned and separated by at least four (4) inches. Where Wiring of differing classifications must cross, they shall cross perpendicular to one another.
5. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.
6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.
7. Replace the entire length of the run of any wire or cable that is damaged or abraded during installation. There are no acceptable methods of repairing damaged or abraded wiring.
8. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
9. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
10. Do not use tape-based or glue-based cable anchors.
11. Ground shields and drain wires as indicated by the drawings or recommended by the OEM.

12. Field wiring entering equipment racks shall be terminated as follows:
    a. Provide ample service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.
    b. If specified terminal blocks are not designed for rack mounting, utilize 3/4 inch plywood or 1/8 inch thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.
    c. Employ permanent strain relief for any cable with an outside diameter of 1 inch or greater.
13. Make all connections as follows:
    a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.
    b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
    c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.
    d. Wire nuts, electrical tape or “Scotch Lock” connections are not acceptable for any application.

D. Cable Installation - In addition to the mandatory infrastructure requirements outlined in VA Construction Specification, Section 27 10 00, STRUCTURED CABLING, the following additional practices shall be adhered to:
1. Support cable on maximum 2’-0” centers. Acceptable means of cable support are cable tray, j-hooks, and bridal rings. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.
2. Run cables parallel to walls.
3. Install maximum of 10 cables in a single row of J-hooks. Provide necessary rows of J-hooks as required by the number of cables.
4. Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2’-0” clearance from all shielded electrical apparatus.

5. All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the Owner.
6. Ends of cables shall be properly terminated on both ends per industry and OEM’s recommendations.
7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off the floor until you are ready to terminate.
8. Cover the end of the overall jacket with a 1 inch (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2 inches (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2 inches (minimum) past the Heat-shrink and serve as indicated below.
9. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing 1/4 inch past the end of unused wires, fold back over jacket and secure with cable tie.
10. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.
11. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
12. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
13. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
14. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
15. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
16. Separation of Wires: (Refer to Raceway Installation) Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same

enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

17. Serve all cables as follows:
    a. Cover the end of the overall jacket with a 1 inch (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2 inches (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2 inches (minimum) past the heat-shrink and serve as indicated below.
    b. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing 1/4 inch past the end of unused wires, fold back over jacket and secure with cable tie.
    c. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.

F. Labeling:
1. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
2. Engrave and paint fill all receptacle panels using 1/8” (minimum) high lettering and contrasting paint.
3. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8” (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.
4. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
5. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
6. Contractor’s name shall appear no more than once on each continuous set of racks. The Contractor’s name shall not appear on wall plates or portable equipment.
7. Provide printed labels at both ends of the cable.

8. Ensure each OEM supplied equipment has appropriate UL Labels/Marks for the service the equipment is performed permanently attached/marked. Equipment installed not bearing these UL marks will not be allowed to be part of the system. The Contractor shall bear all costs required to provide replacement equipment with approved UL marks.

3.4 SYSTEM PROGRAMMING

Provide all programming required for a complete and operational system. Coordinate programming parameters with Owner and Engineer.

3.5 PROTECTION OF NETWORK DEVICES

Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician come in contact with high voltage.

3.6 CLEANING AND PATCHING

A. It shall be the responsibility of the Contractor to keep their work area clear of debris and clean area daily at completion of work.
B. It shall be the responsibility of the Contractor to patch and paint any wall or surface that has been disturbed by the execution of this work.
C. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.
D. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor the Contractor’s consent to cutting or otherwise altering the Work.
E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the

location shall be approved by the Project Manager prior to commencement of coring work.

3.7 FIREPROOFING

A. Where cables penetrate fire rated walls, floors and ceilings, fireproof the opening.

B. Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls. After the cabling installation is complete, install fireproofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.

C. Use only materials and methods that preserve the integrity of the fire stopping system and its rating.

3.8 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Division 26, Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

D. Do not use “3rd or 4th” wire internal electrical system conductors for ground.

E. Do not connect system ground to the building’s external lightning protection system.

F. Do not “mix grounds” of different systems

PART 4 -TESTING/GUARANTY/TRAINING

4.1 PROOF OF PERFORMANCE TESTING

A. Intermediate Testing:

1. After completion of 25 – 30 percent of the installation of a head end cabinet(s) and equipment, one IC master station, local and remote intercom stations, and prior to any further work, this portion of the system must be pretested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed, NFPA, Life Safety, and JCAHCO guidelines are followed, and proper installation

practices are followed. The intermediate test shall include a full operational test.

2. The inspection and test will be conducted by a factory-certified representative and witnessed by a Government Representative. The results of the inspection will be officially recorded by the Government Representative and maintained on file by the COTR, until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75 percent of the system construction phase, at the direction of the COTR.

B. Pretesting:

1. Upon completing installation of the system, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.
2. Pretesting Procedure:
   a. During the system pretest the Contractor shall verify (utilizing approved test equipment) that the system is fully operational and meets all the system performance requirements of this standard.
   b. The Contractor shall pretest and verify that all system functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a minimum, each of the following locations shall be fully pretested:
      1) Central Control Cabinets.
      2) All Networked locations.
      3) System trouble reporting.
      4) System electrical supervision.
      5) UPS operation.
3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the system is ready for the formal acceptance test shall be submitted to the COTR.

C. Acceptance Test:

1. After the system has been pretested and the Contractor has submitted the pretest results and certification to the COTR, then the Contractor shall schedule an acceptance test date and give the COTR

(30) days written notice prior to the date the acceptance test is expected to begin. The system shall be tested in the presence of a Government Representative and an OEM certified representative. The system shall be tested utilizing the approved test equipment to certify proof of performance. The test shall verify that the total system meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed system does comply with all requirements of this specification under operating conditions. The system shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the system that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the system. Repeated failures that result in a cumulative time of eight (8) hours to affect repairs shall cause the entire system to be declared unacceptable. Retesting of the entire system shall be rescheduled at the convenience of the Government.

D. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:

a. The Government Representative will tour all major areas where the system is and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.

b. The system diagrams, record drawings, equipment manuals, Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.

c. Failure of the system to meet the installation requirements of this specification shall be grounds for terminating all testing.

2. Operational Test:

a. After the Physical and Mechanical Inspection, the central terminating and nurse call master control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter may be utilized to accomplish this requirement.

b. Individual Item Test: The Government Representative will select individual items of equipment for detailed proof of performance testing until 100 percent of the system has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.

3. Test Conclusion:

a. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the COTR. Any retesting to comply with these specifications will be done at the Contractor's expense.

b. If the system is declared unacceptable without conditions, all rescheduled testing expenses will be born by the Contractor.

E. Acceptable Test Equipment:

1. The test equipment shall furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
2. Spectrum Analyzer.
3. Signal Level Meter.
4. Volt-Ohm Meter.
5. Sound Pressure Level (SPL) Meter.
6. Oscilloscope.

4.2 SYSTEM GUARANTEE PERIOD OF SERVICE

A. Contractor’s Responsibility:

1. The Contractor shall guarantee that all provided material and equipment will be free from defects, workmanship and will remain so for a period of one year from date of final acceptance of the system by the VA. The Contractor shall provide OEM’s equipment warranty

documents, to the COTR that certifies each item of equipment installed conforms to OEM published specifications.

2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
3. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the two year guaranty period:
   a. Response Time During the Two Year Guaranty Period:
      1) The COTR is the Contractor’s ONLY OFFICIAL reporting and contact official for Security Emergency Call and Duress Alarm system trouble calls, during the guaranty period.
      2) A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the COTR, Monday through Friday exclusive of Federal Holidays.
      3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
         a) A routine trouble call within one (1) working day of its report. A routine trouble is considered a trouble which causes a single intercom station inoperable.
         b) An emergency trouble call within four hours of its report. An emergency trouble is considered a trouble which causes a sub-system (ward), distribution point, terminal cabinet, to be inoperable at anytime.
   b. Required On-Site Visits During the Two Year Guaranty Period
      1) The Contractor shall visit, on-site, for a minimum of eight (8) hours, once every 12 weeks, during the guaranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the system according the descriptions identified in this document.

2) The Contractor shall arrange all Facility visits with the COTR prior to performing the required maintenance visits.
3) Preventive maintenance shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the COTR and Contractor.
4) The preventive maintenance schedule, functions and reports shall be provided to and approved by the COTR.
5) The Contractor shall provide the COTR a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the COTR with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
   a) The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to COTR by the fifth (5th) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
   b) The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the system. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
6) The COTR shall convey to the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
   a) The COTR shall ensure a copy of these reports is entered into the system’s official acquisition documents.
   b) The Facility Chief Engineer shall ensure a copy of these reports is entered into the system’s official technical record documents.

B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, Contractor, or Owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the COTR in writing upon the discovery of these incidents. The COTR will investigate all reported incidents and render his decision.

4.3 TRAINING

A. Provide thorough training of all nursing staff assigned to those nursing units receiving new networked nurse/patient communications equipment. This training shall be developed and implemented to address two different types of staff. Floor nurses/staff shall receive training from their perspective, and likewise, unit secretaries (or any person whose specific responsibilities include answering patient calls and dispatching staff) shall receive operational training from their perspective. A separate training room will be set up that allows this type of individualized training utilizing in-service training unit, prior to cut over of the new system.

B. Provide the following minimum training times and durations:

1. 24 hours for supervisors and system administrators.

- - - E N D - - -

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the specifications includes the furnishing, installation, and connection of fire alarm equipment to an existing building fire alarm system to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring as shown on the drawings and specified.

B. Fire alarm systems shall comply with requirements of NFPA 72 unless variations to NFPA 72 are specifically identified within these contract documents by the following notation: "variation". The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the Contracting Officer or his authorized representative. Installers shall have a minimum of two years experience installing fire alarm systems.

C. Fire alarm signals:

1. The Medical Center Building has an automatic digitized voice fire alarm signal with emergency manual voice override to notify occupants to evacuate. The digitized voice message can identify the area of the building (smoke zone) from which the alarm was initiated.

D. Alarm signals (by device), supervisory signals (by device) and system trouble signals (by device not reporting) shall be distinctly transmitted to the main fire alarm system control unit.

E. The main fire alarm control unit shall automatically transmit alarm signals to a listed central station using a digital alarm communicator transmitter in accordance with NFPA 72.

1.2 SCOPE

A. All existing fire alarm equipment, wiring, devices and sub-systems that are not shown to be reused shall be removed. All existing fire alarm conduit not reused shall be removed. Contractor shall properly dispose of all items that are removed.

B. New fire alarm system devices connected to the existing building fire alarm system shall be designed and installed in accordance with the specifications and drawings. Device location and wiring runs shown on the drawings are for reference only unless specifically dimensioned. Actual locations shall be in accordance with NFPA 72 and this specification.

C. Existing fire alarm bells, chimes, door holders, 120VAC duct smoke detectors, valve tamper switches and waterflow/pressure switches may be reused only as specifically indicated on the drawings and provided the equipment:
   1. Meets this specification section
   2. Is UL listed or FM approved
   3. Is compatible with new equipment being installed
   4. Is verified as operable through contractor testing and inspection
   5. Is warranted as new by the Contractor.

D. Existing 120 VAC duct smoke detectors, waterflow/pressure switches, and valve tamper switches reused by the Contractor shall be equipped with an addressable interface device compatible with the new equipment being installed.

E. Existing reused equipment shall be covered as new equipment under the Warranty specified herein.

F. Basic Performance:
   1. Response time between alarm initiation (contact closure) and recording at the main fire alarm control unit (appearance on alphanumeric read out) shall not exceed five (5) seconds.
   2. Initiating device circuits (IDC) shall be wired Style C in accordance with NFPA 72.
   3. Signaling line circuits (SLC) within the building shall be wired Style 4 in accordance with NFPA 72. Individual signaling line circuits shall be limited to covering 22,500 square feet of floor space or 3 floors whichever is less.
   4. Notification appliance circuits (NAC) shall be wired Style Y in accordance with NFPA 72.

1.3 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS: Restoration of existing surfaces.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES: Procedures for submittals.
C. Section 07 84 00, FIRESTOPPING: Fire proofing wall penetrations.
D. Section 08 71 00, DOOR HARDWARE: Combination Closer-Holders.
E. Section 09 91 00, PAINTING: Painting for equipment and existing surfaces.
F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements for items which are common to other Division 26 sections.
G. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and boxes for cables/wiring.
H. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW) for cables/wiring.

1.4 SUBMITTALS

A. General: Submit (4) copies and (1) reproducible in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
B. Drawings:
   1. Prepare drawings using AutoCAD software and include all contractors information. Layering shall be by VA criteria as provided by the Contracting Officer’s Technical Representative (COTR). Bid drawing files on AutoCAD will be provided to the Contractor at the pre-construction meeting. The Contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.
   2. Floor plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, equipment, junction/terminal cabinets/boxes, risers, electrical power connections, individual circuits and raceway routing, system zoning; number, size, and type of raceways and conductors in each raceway; conduit fill calculations with cross section area percent fill for each type and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions.

3. Riser diagrams: Provide, for the scope of work for this project, the number, size and type of riser raceways and conductors in each riser raceway and number of each type device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Styles on the riser diagram for all circuits.
4. Detailed wiring diagrams: Provide for control panel connections, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures and equipment configuration.
5. Two weeks prior to final inspection, the Contractor shall deliver to the COTR one (1) set of reproducible, as-built drawings, two blueline copies and one (1) set of the as-built drawing computer files (using AutoCAD software). As-built drawings (floor plans) shall show all new and existing conduit used for the fire alarm system.

C. Manuals:
1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.
   a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion and maintenance.
   b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
   c. Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
   d. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length limitations.
   e. Complete listing of all digitized voice messages.

f. Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include the magnets for holding the doors open for one minute.
g. Include information indicating who will provide emergency service and perform post contract maintenance.
h. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.
i. A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the VAMC and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.
j. Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.
k. A print out for all devices proposed on each signaling line circuit with spare capacity indicated.

2. Two weeks prior to final inspection, deliver four copies of the final updated maintenance and operating manual to the COTR.
   a. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.
   b. Complete "As installed" wiring and schematic diagrams shall be included that shows all items of equipment and their interconnecting wiring. Show all final terminal identifications.
   c. Complete listing of all programming information, including all control events per device including an updated input/output matrix.
   d. Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.
   e. Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.

D. Certifications:
1. Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of

contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name and title of the manufacturer's representative who makes the certification.

2. Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.
3. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

1.5 WARRANTY

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of five (5) years from the date of acceptance of the entire installation by the Contracting Officer.

1.6 GUARANTY PERIOD SERVICES

A. Complete inspection, testing, maintenance and repair service for the fire alarm system shall be provided by a factory trained authorized representative of the manufacturer of the major equipment for a period of five years from the date of acceptance of the entire installation by the Contracting Officer.
B. Contractor shall provide all necessary test equipment, parts and labor to perform required inspection, testing, maintenance and repair.
C. All inspection, testing, maintenance and permanent records required by NFPA 72, and recommended by the equipment manufacturer shall be provided by the Contractor. Work shall include operation of sprinkler system alarm and supervisory devices as well as all reused existing equipment connected to the fire alarm system. It shall include all interfaced equipment including, but not limited to, elevators, HVAC shutdown, and extinguishing systems.
D. Maintenance and testing shall be performed in accordance with NFPA 72. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment and cleaning of all equipment.

E. Non-included Work: Repair service shall not include the performance of any work due to improper use, accidents, or negligence for which the contractor is not responsible.

F. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of the work performed and parts replaced shall be provided to the VA Contracting Officer or his authorized representative.

G. Emergency Service:

1. Warranty Period Service: Service other than the preventative maintenance, inspection, and testing required by NFPA 72 shall be considered emergency call-back service and covered under the warranty of the installation during the first year of the warranty period, unless the required service is a result of abuse or misuse by the Government. Written notification shall not be required for emergency warranty period service and the contractor shall respond as outlined in the following sections on Normal and Overtime Emergency Call-Back Service. Warranty period service can be required during normal or overtime emergency call-back service time periods at the discretion of the Contracting Officer or his authorized representative.
2. Normal and overtime emergency call-back service shall consist of an on-site response within two hours of notification of a system trouble.
3. Normal emergency call-back service times are between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday, exclusive of federal holidays. Service performed during all other times shall be considered to be overtime emergency call-back service. The cost of all normal emergency call-back service for years 2 through 5 shall be included in the cost of this contract.
4. Overtime emergency call-back service shall be provided for the system when requested by the Government. The cost of the first (40) manhours per year of overtime call-back service during years 2 through 5 of this contract shall be provided under this contract. Payment for overtime emergency call-back service in excess of the (40) manhours per year requirement will be handled through separate purchase orders. The method of calculating overtime emergency call-back hours is based on actual time spent on site and does not include travel time.

H. The Contractor shall maintain a log at each fire alarm control unit. The log shall list the date and time of all examinations and trouble calls, condition of the system, and name of the technician. Each trouble call shall be fully described, including the nature of the trouble, necessary correction performed, and parts replaced.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only.

B. National Fire Protection Association (NFPA):
70-2005.....National Electrical Code (NEC).
72-2002.....National Fire Alarm Code.
90A-2002.....Installation of Air Conditioning and Ventilating Systems.
101-2003.....Life Safety Code

C. Underwriters Laboratories, Inc. (UL):
2000-2000.....Fire Protection Equipment Directory

D. Factory Mutual Research Corp (FM): Approval Guide, 2005 Edition

E. American National Standards Institute (ANSI):
S3.41-1996.....Audible Emergency Evacuation Signal

F. International Code Council, International Building Code (IBC) 2003 Edition

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS, GENERAL

A. Existing equipment may be reused only where indicated on the drawings.

B. Except as indicated in paragraph A above, All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturer's requirements and that satisfactory total system operation has been achieved.

2.2 CONDUIT, BOXES, AND WIRE

A. Conduit shall be in accordance with Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS and as follows:

1. All new and reused conduit shall be installed in accordance with NFPA 70.

2. Conduit fill shall not exceed 40 percent of interior cross sectional area.
3. All new conduit shall be 19 mm (3/4 inch) minimum.

B. Wire:

1. All existing wiring shall be removed and new wiring installed in a conduit or raceway.
2. Wiring shall be in accordance with NEC article 760, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW), and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.
3. Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded unless specifically excepted by the fire alarm equipment manufacturer in writing.
4. All wire or cable used in underground conduits including those in concrete shall be listed for wet locations.

C. Terminal Boxes, Junction Boxes, and Cabinets:

1. Shall be galvanized steel in accordance with UL requirements.
2. All new and reused boxes shall be sized and installed in accordance with NFPA 70.
3. New and existing covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 19 mm (3/4 inch) high.
4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.
5. Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser. Terminal strips shall be labeled as specified or as approved by the COTR.

2.3 FIRE ALARM CONTROL UNIT

A. General:

1. The Fire Alarm Control Unit is existing.

2.4 ALARM NOTIFICATION APPLIANCES

A. Speakers:
   1. Shall operate on either 25 VRMS or 70.7 VRMS with field selectable output taps from 0.5 to 2.0W and originally installed at the one-half watt tap. Speakers shall provide a minimum sound output of 80 dBA at ten feet with the one-half watt tap.
   2. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
   3. 100 mm (4 inches) or 200 mm (8 inches) cone type speakers ceiling mounted with white colored baffles in areas with suspended ceilings and wall mounted in areas without ceilings.

B. Strobes:
   1. Xenon flash tube type minimum 15 candela in toilet rooms and 75 candela in all other areas with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72).
   2. Backplate shall be red with 13 mm (1/2 inch) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.
   3. Each strobe circuit shall have a minimum of twenty (20) percent spare capacity.
   4. Strobes may be combined with the audible notification appliances specified herein.

C. Fire Alarm Horns:
   1. Shall be electric, utilizing solid state electronic technology operating on a nominal 24 VDC.
   2. Shall be a minimum nominal rating of 80 dBA at ten feet.
   3. Mount on removable adapter plates on conduit boxes.
   4. Horns located outdoors shall be of weatherproof type with metal housing and protective grille.
   5. Each horn circuit shall have a minimum of twenty (20) percent spare capacity.

2.5 ALARM INITIATING DEVICES

A. Manual Fire Alarm Stations:
   1. Shall be non-breakglass, address reporting type.
   2. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.

3. Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE".
4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
5. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.
6. Stations identified as key operated only shall have a single standardized lock and key separate from the control equipment.

B. Smoke Detectors:
1. Smoke detectors shall be UL listed for use with the fire alarm control unit being furnished.
2. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
3. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
4. All spot type and duct type detectors installed shall be of the photoelectric type.
5. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.
6. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

C. Heat Detectors:
1. Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.
2. Detectors shall have a minimum smooth ceiling rating of 2500 square feet.
3. Intermediate temperature rated (200 degrees F) heat detectors shall be utilized in all other areas.

D. Water Flow and Pressure Switches:

1. Wet pipe water flow switches and dry pipe alarm pressure switches for sprinkler systems shall be connected to the fire alarm system by way of an address reporting interface device.
2. All new water flow switches shall be of a single manufacturer and series and non-accumulative retard type.
3. All new switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Timing shall be recorded and documented during testing.

2.6 SUPERVISORY DEVICES

A. Duct Smoke Detectors:

1. Duct smoke detectors shall be provided and connected by way of an address reporting interface device. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.
2. Interlocking with fans shall be provided in accordance with NFPA 90A and as specified hereinafter under Part 3.2, "TYPICAL OPERATION".
3. Provide remote indicator lamps, key test stations and identification nameplates (e.g. "DUCT SMOKE DETECTOR AHU-X") for all duct detectors. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.

B. Sprinkler and Standpipe System Supervisory Switches:

1. Each sprinkler system water supply control valve, riser valve or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
3. Valve supervisory switches shall be connected to the fire alarm system by way of address reporting interface device.
4. The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 19 mm (3/4 inch) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.

5. The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.
6. Where dry-pipe sprinkler systems are installed, high and low air pressure switches shall be provided and monitored by way of an address reporting interface devices.

2.7 ADDRESS REPORTING INTERFACE DEVICE

A. Shall have unique addresses that reports directly to the building fire alarm panel.
B. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.
C. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.
D. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.
E. Shall be mounted in weatherproof housings if mounted exterior to a building.

2.8 SMOKE BARRIER DOOR CONTROL

A. Electromagnetic Door Holders:
   1. New Door Holders shall be standard wall mounted electromagnetic type. In locations where doors do not come in contact with the wall when in the full open position, an extension post shall be added to the door bracket.
   2. Operation shall be by 24 volt DC supplied from a battery located at the fire alarm control unit. Door holders shall be coordinated as to voltage, ampere drain, and voltage drop with the battery, battery charger, wiring and fire alarm system for operation as specified.
B. A maximum of twelve door holders shall be provided for each circuit. Door holders shall be wired to allow releasing doors by smoke zone.
C. Door holder control circuits shall be electrically supervised.
D. Smoke detectors shall not be incorporated as an integral part of door holders.
E. Where combination holder-closer units are required to match existing, these devices are furnished and installed as per Section 08 71 00, DOOR HARDWARE. Connection and wiring shall be as herein specified.

2.9 UTILITY LOCKS AND KEYS:

A. All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.

B. Key-operated manual fire alarm stations shall have a single standardized lock and key separate from the control equipment.

C. All keys shall be delivered to the COTR.

2.10 SPARE AND REPLACEMENT PARTS

A. Provide spare and replacement parts as follows:

1. Manual pull stations - 5
2. Heat detectors - 2 of each type
3. Fire alarm strobes - 1
4. Fire alarm speakers - 1
5. Smoke detectors - 3
6. Duct smoke detectors with all appurtenances - 1
7. Sprinkler system water flow switch - 1 of each size
8. Sprinkler system water pressure switch - 1 of each type
9. Sprinkler valve tamper switch - 1 of each type
10. Monitor modules - 1
11. Control modules - 1

B. Spare and replacement parts shall be in original packaging and submitted to the COTR.

C. Furnish and install a storage cabinet of sufficient size and suitable for storing spare equipment. Doors shall include a pad locking device. Padlock to be provided by the VA. Location of cabinet to be determined by the COTR.

D. Provide to the VA, all hardware, software, programming tools, license and documentation necessary to permanently modify the fire alarm system on site. The minimum level of modification includes addition and deletion of devices, circuits, zones and changes to system description, system operation, and digitized evacuation and instructional messages.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment manufacturer. Fire alarm wiring shall be installed in conduit. All conduit and wire shall be installed in accordance with Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS , Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW), and all

penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING.

B. All new conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. All existing accessible fire alarm conduit not reused shall be removed.

C. All new or reused exposed conduit shall be painted in accordance with Section 09 91 00, PAINTING to match surrounding finished areas and red in unfinished areas.

D. Existing devices that are reused shall be properly mounted and installed. Where devices are installed on existing shallow backboxes, extension rings of the same material, color and texture of the new fire alarm devices shall be used. Mounting surfaces shall be cut and patched in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Restoration, and be re-painted in accordance with Section 09 91 00, PAINTING as necessary to match existing.

E. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations to be approved by the COTR.

F. Speakers shall be ceiling mounted and fully recessed in areas with suspended ceilings. Speakers shall be wall mounted and recessed in finished areas without suspended ceilings. Speakers may be surface mounted in unfinished areas.

G. Strobes shall be flush wall mounted 2,000 mm (80 inches) above the floor or 150 mm (6 inches) below ceiling, whichever is lower. Locate and mount to maintain a minimum 900 mm (36 inches) clearance from side obstructions.

H. Manual pull stations shall be installed not less than 1050 mm (42 inches) or more than 1200 mm (48 inches) from finished floor to bottom of device and within 1500 mm (60 inches) of a stairway or an exit door.

I. Where possible, locate water flow and pressure switches a minimum of 300 mm (12 inches) from a fitting that changes the direction of the flow and a minimum of 900 mm (36 inches) from a valve.

J. Mount valve tamper switches so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

K. Connect combination closer-holders installed under Section 08 71 00, DOOR HARDWARE.

3.2 TYPICAL OPERATION

A. Activation of any manual pull station, water flow or pressure switch, heat detector, or smoke detector shall cause the following operations to occur:
   1. Operate the emergency voice communication system in the Building. For this sprinkler protected building, flash strobes continuously only in the zone of alarm.
   2. Continuously sound a temporal pattern general alarm and flash all strobes in the building in alarm until reset at the local fire alarm control unit.
   3. Release only the magnetic door holders in the smoke zone on the floor from which alarm was initiated after the alert signal.
   4. Transmit a separate alarm signal, via the main fire alarm control unit to the fire department.
   5. Unlock the electrically locked exit doors within the zone of alarm.

B. Operation of a smoke detector at a corridor door used for automatic closing shall also release only the magnetic door holders on that floor in that smoke zone.

C. Operation of duct smoke detectors shall cause a system supervisory condition and shut down the ventilation system and close the associated smoke dampers as appropriate.

D. Operation of any sprinkler or standpipe system valve supervisory switch, high/low air pressure switch, or fire pump alarm switch shall cause a system supervisory condition.

3.3 TESTS

A. Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the COTR.

B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the COTR. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract requirements. After the system has passed the initial test and been approved by the COTR, the Contractor may request a final inspection.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
3. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.
4. Open each alarm initiating and notification circuit to see if trouble signal actuates.
5. Ground each alarm initiation and notification circuit and verify response of trouble signals.

3.4 FINAL INSPECTION AND ACCEPTANCE

A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last (14) days is without a system or equipment malfunction.

B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article 3.3 TESTS and those required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a VA representative.

3.5 INSTRUCTION

A. The manufacturer's authorized representative shall provide instruction and training to the VA as follows:
   1. Six one-hour sessions to engineering staff, security police and central attendant personnel for simple operation of the system. Two sessions at the start of installation, two sessions at the completion of installation and two sessions 3 months after the completion of installation.
   2. Four two-hour sessions to engineering staff for detailed operation of the system. Two sessions at the completion of installation and two sessions 3 months after the completion of installation.
   3. Three eight-hour sessions to electrical technicians for maintaining, programming, modifying, and repairing the system at the completion of

installation and one eight-hour refresher session 3 months after the completion of installation.

B. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a trouble shooting guide of the system modifications for submittal to the VA. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose leaf binder. When reading the sequence of operation, the reader will be able to quickly and easily determine what output will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.

C. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.

PART 4 - SCHEDULES

4.1 LOCATION OF VOICE MESSAGES:

Upon receipt of an alarm signal from the building fire alarm system, the voice communication system shall automatically transmit a 3 second tone alert and a pre-recorded fire alarm message throughout the floor in alarm, the floor above and the floor below.

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