

**DEPARTMENT OF VETERANS AFFAIRS  
VHA MASTER SPECIFICATIONS**

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Section 00 01 10**

**VOLUME I**

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**SECTION 00 01 15**  
**LIST OF DRAWING SHEETS**

The drawings listed below accompanying this specification form a part of the contract.

<u>Drawing No.</u>	<u>Title</u>
GI0.01	Project Cover Sheet
	PLUMBING, HEATING, VENTILATING, AIR CONDITIONING AND REFRIGERATION
PL-00	Project Title Sheet
PL-01	Mechanical Symbols and Abbreviations
PL-02	Medical Gas Equipment Schedules and Details
PL-03	Overall Site Plan
DM 50-00	Building 50 Sub-Basement Enlarged Medical Gas Demolition Plan
DM 51-00	Building 51 Sub-Basement Enlarged Medical Gas Demolition Plan
PL 49-00	Building 49 Sub-Basement Enlarged Medical Gas Plan
PL 49-01	Building 49 Basement Medical Gas Plan
PL 50-00	Building 50 Sub-Basement Enlarged Medical Gas Plan
PL 50-01	Building 50 Basement Medical Gas Plan
PL 50-02	Building 50 Crawlspace Medical Gas Plan
PL 51-00	Building 51 Sub-Basement Enlarged Medical Gas Plan
PL 51-01	Building 51 Basement Medical Gas Plan
PL 51-02	Building 51 Crawlspace Medical Gas Plan
	ELECTRICAL
EP-01	Electrical Symbols, Schedules, Notes and Abbreviations
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ED 51-00	Building 51 Sub-Basement Enlarged Electrical Demolition Plan
EP 50-00	Building 50 Sub-Basement Electrical Plan
EP 50-01	Building 50 Basement Electrical Plan

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SECTION 01 00 00  
GENERAL REQUIREMENTS

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**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

**1.1 GENERAL INTENTION**

- A. Contractor shall prepare the site for construction and furnish all labor, materials and equipment required to perform the work which includes: demolition of existing medical gas equipment and piping, and installation of new equipment, piping, valves, medical gas system monitoring, electrical and all associated components and incidental trades required as per the plans and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Health Care System Contracting Officer.
- C. Offices of LHB, 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. 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.
- E. Prior to commencing work, general contractor shall provide proof that the project supervisor having an OSHA 30 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.
- F. Training:
  - 1. Beginning July 31, 2005, all employees of general contractor or subcontractors shall have the at minimum the 10-hour OSHA certified Construction Safety course and other relevant competency training, as determined by VA CP with input from the Infection Control Risk Assessment (ICRA) team.
  - 2. Submit training records of all such employees for approval before the start of work.

3. Notice to proceed will be issued not less than 2 weeks after receipt of bonds; time extensions will not be granted because of the need for training.

G. All contractor employees working on this project will be required to obtain and wear while on VA property, a VA picture identification badge. The badge will only be issued to those employees having the appropriate OSHA Construction Safety Cards. The badges will be issued free of charge by the VA. The badges must be returned upon completion of the contract. All ID badges must be returned upon contract completion. There will be a \$200 charge for each ID badge not returned at the end of the contract.

H. Project Acceptance (Substantial Completion):

1. The acceptance of a project for substantial completion is to include the following:

- a. The completion of all items to meet the criteria of the contract drawings and specifications to the satisfaction of the Contracting Officer's Representative (COR). Items for correction may be considered to be punch list items, as determined by the COR, if the COR finds them to be minor in correction. Value for the corrections will be held by the VA, as determined by the COR, until all corrections are completed to the satisfaction of the COR.
- b. The VA will not accept a project, or phase of a project as determined by contract documents, as substantially complete until a complete passing test and balance report of the HVAC system has been submitted and accepted as complete and passing by the COR. It is recommended that the HVAC system be completed with sufficient time to make corrections to submit a passing report. A time extension to the contract will not be considered for corrections to the HVAC system that are determined by the COR to be installation or design errors if within the contract.

## **1.2 STATEMENT OF BID ITEMS**

A. BASE BID: Contractor shall furnish all labor, materials, tools and equipment required for the construction operations shown, to include: General Requirements, Demolition, Construction Waste Management, Sustainable Design Requirements, Metals, Plumbing, Electrical and certain other items.

B. ALTERNATE NO.1: None

### 1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. AFTER AWARD OF CONTRACT, Contractor is to provide his/her own drawings and specifications as downloaded from WWW: FBO.gov

### 1.4 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security Plan: The requirements for security are as follows:

1. All contractor and subcontractor employees that are to be on VA grounds are to submit the information following to the badge Sponsor/Manager (COR) at least two weeks previous to requesting a badge. All employees of the contractor may be subject to a background investigation and the VA has the right to refuse to badge any employee that would not pass the background investigation. It is expected that the contractor will have the employee scheduled for the issuance of a badge well in advance of starting work. Due to the badge process, the employee will not be able come to the VA, receive badge, and conduct work on same day. There will be a \$200 fine for badges issued and not returned upon completion of project.

Sponsor/Manager Info for contractors: James Cross

Initial Badge Submission Requirements:

First, middle and last name (as shown on picture ID)

DOB

SSN

Height

Eye Color

Hair Color

Name of Firm or Company

VA project name

Name of COR

Contract End Date

2. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
3. The General Contractor is responsible for assuring that all subcontractors 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. Door hardware installed in construction doors is to be self closing and storage function lock, able to receive a BEST 7 pin core and only operable with a key. The VA will install the construction core and issue keys to the contractor's personnel. All construction fences are to be locked with a VA lock in series so VA engineering and police personnel have emergency access at all times. Keys to necessary construction areas can be checked out with the approval of the COR. The contractor is to give a minimum of 1 week notice for security approval for areas that need to be entered for construction purposes.
2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation.
3. VA construction core keys will be issued to the contractor as deemed necessary by the COR. All keys must be returned when no longer needed or upon completion of the contract. There will be a \$25 charge for each key not returned at the end of the contract. Should VA security be compromised as a result of failure to return a key(s), there will be an additional charge to the contractor of \$25 for each door re-cored.

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.
3. 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.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
7. 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.

#### **1.5 FIRE SAFETY AND OSHA SAFETY PLAN**

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 COR and Facility Safety Officer 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 COR that individuals have undergone contractor's safety briefing.
- C. OSHA Safety Plan: The contractor is to submit a safety plan modified to cover the scope of the project. This safety plan is to be submitted for review by the Facility Safety Officer for compliance. All subcontractors are to have their own safety plan per OSHA requirements and must align and comply with the general contractor's approved safety plan. The contractor is also to submit all required Material Safety Data Sheets (MSDS) that apply to the project for VA file (electronic copy is preferred).
- D. 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.

- E. 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 9 m (30 feet).
- F. Temporary Construction Partitions: (NO WOOD ALLOWED)
1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions are to be constructed of gypsum board on metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Ceilings are to be replaced on occupied side of barrier during construction. These partitions may be shown on drawings as an example of location but not totally inclusive. Any location defined as a construction area that would require fire and/or safety separation for patients and staff requires approved construction barriers at the discretion of the facility safety officer and the COR. Seal joints and penetrations. At door openings, install Class C,  $\frac{3}{4}$  hour fire/smoke rated doors with self-closing devices.
  2. Install two-hour fire-rated temporary construction partitions as shown on drawings 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.
- G. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- H. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with the COR.
- I. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to the COR.

- J. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- K. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- L. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather protected.
- M. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- N. 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 the COR. 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 COR.
- O. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with the COR.
- P. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with the COR. Obtain permits from facility COR at least one hour in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- Q. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to the COR and facility Safety Officer.
- R. 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.

- S. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- T. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- U. If required, submit documentation to the COR 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, or use temporary roadways constructed by the Contractor 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, space available for storing materials and available contractor parking shall be provided as indicated on the drawings. The contractor is responsible for providing additional off-site staging, parking, logistical and material handling support as required to maintain efficient construction operations while minimizing the impacts to VA patients, staff, facilities and other contractors.

- E. Workmen are subject to rules of Health Care System applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of Health Care System 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 COR 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 Health Care System areas required to remain in operation.
  3. Where access by Health Care System 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. Phasing: Contractor shall furnish the COR with a schedule showing the proposed phasing dates when they plan to complete the scope of work indicated. In addition, Contractor shall notify the COR two weeks in advance of the proposed starting date for phase I. The phasing dates are to be logically arranged so as to ensure accomplishment of the work in successive phases mutually agreeable to the COR and the Contractor. The proposed phasing plan is as follows:

Phase I work includes:

1. Demolition and installation of new medical gas equipment in Building 50 with electrical power wiring and start-up.
2. Installation of new alarm distribution wiring.
3. Installation of new crawlspace medical gas mains.
4. Installation of new 2-1/2" Medical Vacuum riser in Building 51, from mechanical room to second floor.

5. Replacement of the oxygen lines in the mechanical rooms and installation of the new emergency oxygen service connections (this can be performed in either phase and is not a condition for the start phase II).

Phase II work includes:

1. Mechanical room medical gas piping demolition and new service connections.
2. Installation of new medical gas service valves.
3. Termination and testing of the new medical gas monitoring alarm systems.
4. Demolition of the existing medical gas equipment and electrical in Building 51 as well as demolition of the existing medical gas mains in the crawlspace as well as the Building 51 pipe chase.

#### H. SPECIAL PHASING REQUIREMENTS:

1. Buildings 49, 50 and 51 will be occupied for the duration of the contract. The contractor shall perform all work in or adjacent to VA occupied areas in such a manner to ensure:
  - a. The continuous and uninterrupted use of all occupied areas, including the applicable mechanical and electrical systems serving these areas.
  - b. Protection of patients and personnel in occupied areas from the hazards and dust associated with a construction environment.
  - c. The work areas are to be kept clear, clean, and free of loose debris, construction materials, and partial installations presenting a hazard to safety or interfere with patient and personnel operations or movement. The contractor shall sweep the areas clean at the end of each work day and make every effort to keep dust and noise to a minimum at all times.
  - d. Temporary interruptions or shutdown of any utility or electrical/mechanical system must be requested through the COR and submitted 72 hours in advance. These facilities operate 24/7 and will require close coordination with the COR. Outages involving after hours work may be required and should be included to be performed at the discretion of the COR.

- e. Service interruptions of the medical air, medical vacuum, and oxygen services shall be kept to a maximum of 8 hours per occurrence.
  - f. The Contractor shall provide the temporary pipe manifolds, connections and valves necessary for the demolition and installation of the new equipment while maintaining medical air and medical vacuum services to Building 50, which is currently supplied from Buildings 49 and 51. The existing equipment in Building 50 is currently out of service. Once installation and startup of the new systems are complete, demolition of the Building 51's medical gas systems can occur.
  - g. Prior to commencing work, the contractor shall submit a detailed installation plan for approval by the COR. The plan shall be organized and staffed as needed to control the number of service interruptions to the absolute minimum required in order to minimize the inconvenience to the VA HCS patients and staff.
  - h. Two weeks (14 calendar days) prior to the proposed start date for phase II, the contractor shall notify the COR, in writing, of the planned completion date for phase I. In no case will the contractor be allowed to start work in phase II without written approval from the COR.
- I. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.
- J. 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 COR. 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.

K. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction staging area indicated on the drawings or as required confining all construction activities. Provide gates as required for access with necessary hardware, including hasps and padlocks. Contractor must provide hardware on gate to provide exit ability of contractor's staff and not allow access to patients at the facility. VA engineering staff must have the ability to access this gate at any time. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by the COR.

L. When a 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 Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.

M. 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 COR.

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 COR. All service interruptions require



careful planning and coordination. Outages, to the fullest extent possible, will be conducted during normal working hours but work affecting VA health care services will be scheduled outside normal clinic hours. The use of facility emergency generators to support minor electrical interruptions will be considered on a case by case basis. No "HOT TAPPING" of any utility service other than storm or sanitary utilities is allowed unless under extreme circumstances. If these circumstances are determined appropriate and approved by the COR, all work must follow Facilities Management Memorandum 23 "Hot Tapping Procedures". All services under work shall be isolated and all energy released before work begins. 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 Health Care System 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 the COR, 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 Health Care System. Interruption time approved by Health Care System may occur at other than Contractor's normal working hours.
4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
5. In case of a contract construction emergency, service will be interrupted on approval of the COR. 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.

- N. 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.
- O. To minimize interference of construction activities with flow of Health Care System 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. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
  2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.
- P. Coordinate the work for this contract with other construction operations as directed by the COR. This includes the scheduling of deliveries 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 COR of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, 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 buildings.
  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 COR.
- 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 COR 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 COR 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 of VAHCC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group as specified here. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to COTR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- C. Health Care Center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the Health Care Center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:
  - 1. The COTR and VAHCC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.
  - 2. In case of any problem, the Health Care Center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.
- 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 COTR. Blank off

ducts and diffusers to prevent circulation of dust into occupied areas during construction and to keep duct work to remain free of dust and debris. All ductwork determined to be contaminated during construction shall be cleaned by the contractor at the contractor's expense.

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 Health Care Center and Contractor's workers, the Contractor shall:

- a. Provide dust proof deck to deck minimum one-hour fire-rated temporary drywall on metal stud construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. The barrier must be constructed to the equivalence of the separation it replaces for fire and smoke rating. Barriers shall be sealed, painted, made presentable and maintained on hospital occupied side. Barrier also to be two sided with sound proofing insulation if in a patient accessible area. Install a self-closing rated door with a in a metal frame, commensurate with the partition, to allow worker access. The door shall be provided with a positive latch and lock that will accept a 7-pin BEST core. VA will key this lock to the VA construction key. Maintain negative air at all times. Negative air shall be exhausted at a rate of 4 air changes per hour. Approved exhaust fans and air scrubbers provided for negative air shall display their exhaust rate, and shall be ducted to a window and sealed to prevent air infiltration from the outside. Window box fans are not acceptable. Contractor must provide a means to show the COTR that negative air is provided upon request at any time. Preservation of areas designated as "clean" or "sterile", including requirements of air pressure and volumes of air exchanges, shall receive paramount consideration in all work phases. Air exchanges and pressures required by VA SPD Design Standard shall be maintained in required spaces throughout the project at contractor's expense. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and cannot exceed one 8 hour tour. If the work is to take longer, a sheet rock and metal stud barrier is to be used unless an agreement is reached with the COTR and Health Care System.

- b. Insure continuous negative air pressures occurring within the work area. Air scrubbers with HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the Health Care Center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% 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 prefilter 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 Health Care Center.
- c. 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 Health Care Center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
- d. Vacuum and wet mop all transition areas from construction to the occupied Health Care 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.
- e. The contractor shall not haul debris through patient-care areas without prior approval of the COTR and the Health Care 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.
- f. 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.

- g. 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.
- h. 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 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 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 by the COR.
- 2. Items not reserved shall become property of the Contractor and be removed by Contractor from Health Care System.
- 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 Transformers and Capacitors: The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) transformers and capacitors. The transformers and capacitors shall be taken out of service 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. Upon removal of PCB transformers and capacitors for disposal, the "originator" copy of the Uniform Hazardous Waste Manifest (EPA Form 8700-22), along with the Uniform Hazardous Waste Manifest Continuation Sheet (EPA Form 8700-22A) shall be returned to the Contracting Officer who will annotate the contract file and transmit the Manifest to the Health Care System Chief.
  - 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 is not to be removed and which does 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 Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements. At a minimum, the contractor is to comply with all EPA regulations for protection from storm water pollution that would be caused by construction and implement all required safeties to maintain compliance. Also, all wash downs for concrete trucks is to be conducted off site. No containment areas are allowed on site.
- D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) or Storm Water pollution Prevention Plan (SWPPP) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and

permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:

- Designating areas for equipment maintenance and repair;
- Providing waste receptacles at convenient locations and provide regular collection of wastes;
- Locating equipment wash down areas on site, and provide appropriate control of wash-waters; concrete truck wash down is not allowed on site.
- Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
- Providing adequately maintained sanitary facilities.

#### **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 COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR 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).

#### **1.12 PHYSICAL DATA**

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by Northern Technologies, Inc., 6588 141st Avenue NW, Ramsey, Minn esota 55303.
- B. Subsurface conditions have been developed by core borings and test pits. Logs of subsurface exploration are shown diagrammatically on drawings.
- C. A copy of the soil report will be made available for inspection by bidders upon request to the Contracting Officer at the VA Health Care System, St. Cloud Minnesota and shall be considered part of the contract documents.
- D. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

#### **1.13 PROFESSIONAL SURVEYING SERVICES**

- A. A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

#### **1.14 LAYOUT OF WORK**

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.
- B. Establish and plainly mark center lines for each building and/or addition to each existing building, and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition, roads, and parking lots are in accordance with lines and elevations shown on contract drawings.
- C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:
  - 1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the COR before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.
- D. During progress of work, and particularly as work progresses from floor to floor, Contractor shall have line grades and plumbness of all major form

work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the COR before any major items of concrete work are placed. In addition, the Contractor shall furnish to the COR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.

1. Lines of each building and/or addition.
  2. Elevations of bottoms of footings and tops of floors of each building and/or addition.
  3. Lines and elevations of sewers and of all outside distribution systems.
  4. Lines of elevations of all swales and interment areas.
  5. Lines and elevations of roads, streets and parking lots.
- E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to the COR.
- F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

#### **1.15 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 COR's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

#### **1.16 USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on Health Care System property and, when authorized by the COR, 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.
- C. When certain buildings (or parts of certain buildings) are required to be completed in advance of general date of completion, all roads leading thereto must be completed and available for use at time set for completion of such buildings or parts thereof.

#### **1.17 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 COR. If the equipment is not installed and maintained in accordance with the following provisions, the COR 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.

#### **1.18 TEMPORARY TOILETS**

- A. Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by the COR, provide suitable dry closets where directed. 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 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 for all utilities used for construction at Contractor's expense and furnish VA St. Cloud Health Care System a monthly record of the Contractor's usage of utilities 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 Health Care System heating distribution system.

- a. Steam is available at no cost to Contractor.

- b. Electric Resistance heat is not allowed.

- c. Temporary gas/fuel heaters are only allowed with a submitted plan that is approved by the COR and facility Safety Officer. All gas/fuel is to be supplied by the contractor at contractor's expense.

E. Electricity (for Construction and Testing): Furnish all temporary electric services. (Need to discuss as to quantity to be used for determination of charges to the contractor.)

1. Obtain electricity by connecting to the Health Care System 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. (Need to discuss as to quantity to be used for determination of charges to the contractor.)

1. Obtain water by connecting to the Health Care System 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 COR's discretion) of use of water from Health Care System's distribution system.
- G. Steam: Furnish steam system for testing required in various sections of specifications. (Need to discuss as to quantity to be used for determination of charges to the contractor.)
1. Obtain steam for testing by connecting to the Health Care System steam distribution system. Steam is available at no cost to the Contractor.
  2. Maintain connections, pipe, fittings and fixtures and conserve steam use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at the COR's discretion), of use of steam from the Health Care System's distribution system.
- H. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler-burner setup, adjustments, or modifications due to improper design or operation of boiler, burner, or control devices shall be furnished by the Contractor at Contractor's expense.

#### **1.20 NEW TELEPHONE EQUIPMENT**

- A. The contractor shall coordinate with the work of installation of telephone equipment by others. This work shall be completed before the building is turned over to VA.

#### **1.21 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. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.

- 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.

#### **1.22 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the COR 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 COR and shall be considered concluded only when the COR 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 COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

#### **1.23 GOVERNMENT-FURNISHED PROPERTY**

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the Schedule or drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the ST. Cloud VA Health Care System.
- C. The Contractor shall be prepared to receive the equipment from the Government, unload and store or place such equipment not less than 90 days before the Completion Date of the 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 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 COR.

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 CONSTRUCTION SIGN**

- A. Not Permitted.

**1.26 SAFETY SIGN**

- A. Provide a Safety Sign where directed by COR.

**1.27 HISTORIC PRESERVATION**

- A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the COR verbally, and then with a written follow up.

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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 (including laboratory samples to be tested), 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 COTR, 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 (including any laboratory samples to be tested) 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 COTR on behalf of 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.

- 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 COTR 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. COTR assumes no responsibility for checking quantities or exact numbers included in such submittals.
  - A. Submit material and finish samples in quadruplicate. Submit other samples in single units unless otherwise specified. Submit seven (7) copies of shop drawings, schedules, manufacturers' literature and data, and certificates, 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 or courier 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, Project Number, Project Title, 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.
  - C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory

Tests shall be tested, at the expense of Contractor, in a commercial laboratory approved by Contracting Officer.

1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
  2. Certificates shall also set forth a list of comparable projects upon which the laboratory has performed similar functions during past five years.
  3. Samples and laboratory tests shall be sent directly to approved commercial testing laboratory.
  4. Contractor shall send a copy of transmittal letter to both COTR simultaneously with submission of material to a commercial testing laboratory.
  5. Laboratory test reports shall be sent directly to COTR for appropriate action.
  6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
  7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- 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 COTR at the site until 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, VA project number, VA Project Title, VA Contract 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. 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 (except laboratory samples), shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to:

James Cross  
Facilities Management Projects  
VA Medical Center 4801 Veterans Drive  
St. Cloud, MN 56303.

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**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycling Contractor requirements include the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 4. Salvage of existing materials and items for reuse or resale.
  - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Wood (trees, tree trimmings, shrubs, etc).
  - 2. Soil.
  - 3. Inerts (eg, concrete, masonry and asphalt).
  - 4. Compostable waste (yard and non-fat food waste): biodegradable landscaping materials).
  - 5. Engineered wood products (lumber, plywood, particle board and I-joists, pallets, crates, wood furniture and furnishings, etc).
  - 6. Metal Ferrous (steel, cast iron, tine, etc).
  - 7. Metal Non-Ferrous (aluminum, brass, copper, lead and appliances, etc).
  - 8. Precious Metals (silver, gold)
  - 9. Fluorescent lamps and ballasts (one tube equals approximately 2.0 lbs)
  - 10. Electronics (computer equipment, medical equipment, etc).
  - 11. Motor Oil (one gallon equals approximately 7.5 lbs).

12. Corrugated cardboard.
13. Paper and fiberboard (office paper, computer paper, envelopes, colored paper and packaging, etc).
14. Roofing materials.
15. Plastics (containers and packaging of all types: #1 PET, #2 HDPE, #3 PVC, #4 LDPE, #5 PP, #6, PSS, #7 Other).
16. Fats and greases.
17. Rubber (Rubber products and tires).
18. Glass containers.
19. Other glass (window panes and plate glass).
20. Textiles
21. Carpet and/or pad.
22. Gypsum board.
23. Insulation.
24. Paint.
25. Plumbing fixtures
26. Electrical wiring.

## **1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 02 41 00, DEMOLITION.

## **1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
  1. Non-recyclable excess or unusable construction materials.
  2. Non-recyclable packaging used for construction products.
  3. Poor planning and/or layout.
  4. Construction error.
  5. Over ordering.
  6. Weather damage.
  7. Contamination.
  8. Mishandling.
  9. Breakage.

- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to reuse and recycle demolition and construction materials to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials. Containers for construction and demolition debris shall be tarped unless adding or removing materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

#### **1.4 TERMINOLOGY**

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

- C. Construction and Demolition Debris: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which clean inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept clean inert waste, such as asphalt and concrete exclusively for the purpose of beneficial fill.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or insoluble or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board or regulatory agency, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
  2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

#### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the Resident Engineer a written construction and demolition debris management plan. The plan shall include, but not be limited to, the following information:
1. Procedures to be used for debris management.
  2. Techniques to be used to minimize waste generation.

3. Analysis of the estimated job site waste to be generated:
  - a. List of each material and quantity to be salvaged, reused, recycled.
  - b. List of each material and quantity proposed to be taken to a landfill.
4. Detailed description of the Means/Methods to be used for material handling.
  - a. On site: Material separation, storage, protection, and protection from weather elements.
  - b. Off site: Transportation means and destination. Include list of materials.
    - 1) Description of materials to be site-separated and self-hauled to designated facilities.
    - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
  - c. The names and locations of mixed debris reuse and recycling facilities or sites.
  - d. The names and locations of trash disposal landfill facilities or sites.
  - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. An itemized monthly summary of construction and demolition debris diversion and disposal that includes the type, quantity, proceeds (+) or cost (-) of each material generated at the work site and disposed of or diverted from disposal through reuse or recycling.

#### **1.6 APPLICABLE PUBLICATIONS**

- A Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC):

LEED Green Building Rating System for New Construction

**1.7 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling by material type and the proceeds (+) or cost (-) for each material type; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

**PART 3 - EXECUTION**

**3.1 COLLECTION**

- A. Provide all necessary containers, bins, tarps and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable and reusable materials are separated from trash and can be transported to respective recycling or reuse facility for processing.
- C. Hazardous wastes shall be separated, labeled, stored, transported and disposed of according to local, state, federal regulations.

**3.2 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 and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.



### 3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include an itemized list of material types, quantities, proceeds (+) or costs (-), and the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, and invoices. Include the net total costs for each disposal.

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**SECTION 01 81 11**  
**SUSTAINABLE DESIGN REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

This Section describes general requirements and procedures to comply with the Guiding Principles for Leadership in High Performance and Sustainable Buildings Memorandum of Understanding incorporated in the Executive Orders 13423 and 13514; Energy Policy Act of 2005 (EPA 2005) and the Energy Independence and Security Act of 2007 (EISA 2007).

**1.2 OBJECTIVES**

- A. To maximize resource efficiency and reduce the environmental impacts of construction and operation, the Contractor during the construction phase of this project shall implement the following procedures:
  - 1. Select products that minimize consumption of energy, water and non-renewable resources, while minimizing the amounts of pollution resulting from the production and employment of building technologies. It is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:
    - a. Include environmental considerations as part of the normal purchasing process.
    - b. Emphasize pollution prevention early in the purchasing process.
    - c. Examine multiple environmental attributes throughout a product's or service's life cycle.
    - d. Compare relevant environmental impacts when selecting products and services.
    - e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
  - 2. Control sources for potential Indoor Air Quality (IAQ) pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.
  - 3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain

and support these objectives in developing means and methods for performing the work of this Contract and in proposing product substitutions and/or changes to specified processes.

4. Use building practices that insure construction debris and particulates do not contaminate or enter duct work prior to system startup and turn over.

### **1.3 RELATED DOCUMENTS**

- A. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT

### **1.4 DEFINITIONS**

- A. Agrifiber Products: Composite panel products derived from agricultural fiber
- B. Biobased Product: As defined in the 2002 Farm Bill, a product determined by the Secretary to be a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials
- C. Biobased Content: The weight of the biobased material divided by the total weight of the product and expressed as a percentage by weight
- D. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that it was obtained from forests certified by a specified certification program
- E. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder
- F. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Section 01 74 19.
- G. Third Party Certification: Certification of levels of environmental achievement by nationally recognized sustainability rating system.
- H. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky

- I. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock
- J. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted from the solid-waste stream after consumer use
- K. Pre-Consumer Recycled Content: Materials that have been recovered or otherwise diverted from the solid-waste stream during the manufacturing process. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part 260 "Guidelines for the Use of Environmental Marketing Claims":  
  
[www.ftc.gov/bcp/grnrule/guides980427](http://www.ftc.gov/bcp/grnrule/guides980427)
- L. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 250 miles (400 km) from the Project site
- M. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without being manufactured
- N. Sealant: Any material that fills and seals gaps between other materials
- O. Type 1 Finishes: Materials and finishes which have a potential for short-term levels of off gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process of installation and/or curing.
- P. Type 2 Finishes: "Fuzzy" materials and finishes which are woven, fibrous, or porous in nature and tend to adsorb chemicals offgas
- Q. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

#### **1.5 SUBMITTALS**

A. Sustainable Design Submittals:

- 1. Alternative Transportation: Provide manufacturer's cut sheets for all bike racks installed on site, including the total number of bicycle

storage slots provided. Also, provide manufacturer's cut sheets for any alternative-fuel refueling stations installed on site, including fueling capacity information for an 8-hour period.

2. Heat Island Effect:

a. Site Paving: Provide manufacturer's cut sheets for all impervious paving materials, highlighting the Solar Reflectance Index (SRI) of the material. Also, provide cut sheets for all pervious paving materials.

b. Roofing Materials: Submittals for roofing materials must include manufacturer's cut sheets or product data highlighting the Solar Reflectance Index (SRI) of the material.

3. Exterior Lighting Fixtures: Submittals must include cut sheets with manufacturer's data on initial fixture lumens above 90° from nadir for all exterior lighting fixtures, and, for parking lot lighting, verification that the fixtures are classified by the IESNA as "full cutoff" (FCO); OR provide documentation that exterior luminaires are IDA-Approved as Dark-Sky Friendly by the International Dark Sky Association (IDA) Fixture Seal of Approval Program.

4. Irrigation Systems: Provide manufacturer's cut sheets for all permanent landscape irrigation system components and for any rainwater harvesting system components, such as cisterns.

5. Water Conserving Fixtures: Submittals must include manufacturer's cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates. Include cut sheets for any automatic faucet-control devices.

6. Process Water Use: Provide manufacturer's cut sheets for all water-consuming commercial equipment (clothes washers, dishwashers, ice machines, etc.), highlighting water consumption performance. Include manufacturer's cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.

7. Elimination of CFCs AND HCFCs: Provide manufacturer's cut sheets for all cooling equipment with manufacturer's product data, highlighting refrigerants; provide manufacturer's cut sheets for all fire-

suppression equipment, highlighting fire-suppression agents; provide manufacturer's cut-sheets for all polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation, highlighting the blowing agent(s).

8. Appliances and Equipment: Provide copies of manufacturer's product data for all Energy Star eligible equipment and appliances, including office equipment, computers and printers, electronics, and commercial food service equipment (excluding HVAC and lighting components), verifying compliance with EPA's Energy Star program.
9. On-Site Renewable Energy Systems: Provide cut sheets and manufacturer's product data for all on-site renewable energy generating components and equipment, including documentation of output capacity.
10. Measurement and Verification Systems: Provide cut sheets and manufacturer's product data for all controls systems, highlighting electrical metering and trending capability components.
11. Salvaged or Reused Materials: Provide documentation that lists each salvaged or reused material, the source or vendor of the material, the purchase price, and the replacement cost if greater than the purchase price.
12. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation:
  - a. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product
  - b. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor's Certificate and Application for Payment. It should indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content, post-consumer recycled content, and combined recycled content value.

13. Regional Materials: Submittals for all products or materials expected to contribute to the regional calculation (excluding MEP systems equipment and components) must include the following documentation:
  - a. Cost of each material or product, excluding cost of labor and equipment for installation
  - b. Location of product manufacture and distance from point of manufacture to the Project Site
  - c. Location of point of extraction, harvest, or recovery for each raw material in each product and distance from the point of extraction, harvest, or recovery to the Project Site
  - d. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of manufacture for each regional material
  - e. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of extraction, harvest, or recovery for each regional material or product, including, at a minimum, gravel and fill, planting materials, concrete, masonry, and GWB
  - f. An electronic spreadsheet that tabulates the Project's total materials cost and regional materials value, expressed as a percentage of total materials cost. This spreadsheet shall be submitted every third month with the Contractor's Certificate and Application for Payment. It should indicate on an ongoing basis, line items for each material, including cost, location of manufacture, distance from manufacturing plant to the Project Site, location of raw material extraction, and distance from extraction point to the Project Site.
14. Biobased Products:
  - a. Rapidly Renewable Products: Submittals must include written documentation from the manufacturer declaring that rapidly renewable materials are made from plants harvested within a ten-year or shorter cycle and must indicate the percentage (by weight) of these rapidly renewable components contained in the candidate products, along with the costs of each of these materials, excluding labor and delivery costs.

- b. Certified Wood: Submittals for all wood-based materials must include a statement indicating the cost of each product containing FSC Certified wood, exclusive of labor and delivery costs, and third party verification of certification from one of the following:
  - 1) Documentation from the supplier verifying that 100% of the wood-based content originates from SFI third-party certified forest lands, identifying the company or companies that performed the SFI third-party certification for both the forest land management and the certified product content.
- 15. Outdoor Air Delivery Monitoring: Provide manufacturer's cut sheets highlighting the installed carbon dioxide monitoring system components and sequence of controls shop drawing documentation, including CO2 differential set-points and alarm capabilities.
- 16. Interior Adhesives and Sealants: Submittals for all field-applied adhesives and sealants, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
  - a. Provide manufacturers' documentation verifying all adhesives used to apply laminates, whether shop-applied or field-applied, contain no urea-formaldehyde.
- 17. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content
- 18. Exterior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on ambient air quality, must include manufacturer's MSDSs or other manufacturer's Product Data highlighting VOC content.
- 19. Floorcoverings:
  - a. Carpet Systems: Submittals for all carpet must include the following:
    - 1) A copy of an assessment from the Building for Environmental and Economic Sustainability (BEES) software model, either Version 3.0 or 4.0, with parameters of the model set as described by this specification section.



- 2) Manufacturer's product data verifying that all carpet systems meet or exceed the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
  - b. Engineered Wood Flooring: Submittals for all engineered wood flooring must include manufacturer's product data verifying certification under either the Greenguard or FloorScore indoor emissions testing program.
20. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.
21. Systems Furniture and Seating: Provide manufacturer's product data verifying that all systems furniture and seating products meet the requirements of one of the following:
  - a. Greenguard certification
  - b. SCS Indoor Advantage certification
  - c. SCS Indoor Advantage Gold certification
  - d. BIFMA Standard X7.1-2005, as tested to BIFMA method M7.1-2005 and as verified by an independent laboratory
  - d. Calculated indoor air concentration limits for furniture systems and seating determined by the U.S. EPA's Environmental Technology Verification Large Chamber Test Protocol for Measuring Emissions of VOCs and Aldehydes (September 1999) testing protocol as conducted in an independent air quality testing laboratory
22. Entryway Systems: Provide manufacturer's cut sheets for all walk-off systems installed to capture particulates, including permanently installed grates, grilles, slotted systems, direct glue-down walk-off mats, and non-permanent roll-out mats.
23. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:

- a. Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs) per ASHRAE HVAC Design Manual for Hospitals and Clinics.
  - b. Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction. See above for requirements
24. Mercury in Lighting: Provide manufacturer's cut sheets or product data for all fluorescent or HID lamps highlighting mercury content.
25. Lighting Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all lighting controls systems components.
26. Thermal Comfort Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all thermal comfort-control systems components.
27. Blended Cement: It is the intent of this specification to reduce CO2 emissions and other environmentally detrimental effects resulting from the production of portland cement by requiring that all concrete mixes, in aggregate, utilize blended cement mixes to displace portland cement typically included in conventional construction. Provide the following submittals:
- a. Copies of concrete design mixes for all installed concrete
  - b. Copies of typical regional baseline concrete design mixes for all compressive strengths used on the Project
  - c. Quantities in cubic yards of each installed concrete mix
28. Gypsum Wall Board: Provide manufacturer's cut sheets or product data verifying that all gypsum wallboard products are moisture and mold-resistant.
29. Fiberglass Insulation: Provide manufacturer's cut sheets or product data verifying that fiberglass batt insulation contains no urea-formaldehyde.
30. Duct Acoustical Insulation: Provide manufacturer's cut sheets or product data verifying that mechanical sound insulation materials in air distribution ducts consists of an impervious, non-porous coatings that prevent dust from accumulating in the insulating materials.

31. Green Housekeeping: Provide documentation that all cleaning products and janitorial paper products meet the VOC limits and content requirements of this specification section.

B. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:

1. Not more than 60 days after the Preconstruction Meeting, the General Contractor shall provide to the Owner and Architect a preliminary schedule of materials costs for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs. Include the following:
  - a. Identify each reused or salvaged material, its cost, and its replacement value.
  - b. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.
  - c. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project site, the source location for each raw material component of the material, the distance of these extraction locations from the Project site, and the total value of regional materials as a percentage of total materials costs.
  - d. Identify each biobased material, its source, its cost, and the total value of biobased materials as a percentage of total materials costs. Also provide the total value of rapidly renewable materials (materials made from plants that are harvested in less than a 10-year cycle) as a percentage of total materials costs.
  - e. Identify each wood-based material, its cost, the total wood-based materials cost, each FSC Certified wood material, its cost, and the total value of Certified wood as a percentage of total wood-based materials costs.

2. Provide final versions of the above spreadsheets to the Owner and Architect not more than 14 days after Substantial Completion.
- C. Construction Waste Management: See Section 01 74 19 "Construction Waste Management" for submittal requirements.
- D. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:
1. Not more than 30 days after the Preconstruction Meeting, prepare and submit for the Architect and Owner's approval, an electronic copy of the draft Construction IAQ Management Plan in an electronic file including, but not limited to, descriptions of the following:
    2. Instruction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling
      - a. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage
      - b. Schedule of submission to Architect of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials
      - c. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille
      - d. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit
  3. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:
    - a. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.

- b. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs).
- 4. Not more than 14 days after Substantial Completion provide the following:
  - a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
  - b. Minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
  - c. A copy of the report from testing and inspecting agency documenting the results of IAQ testing, demonstrating conformance with IAQ testing procedures and requirements defined in Section 01 81 09 "Testing for Indoor Air Quality."
- E. Commissioning: Not applicable.
- F. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:
  - 1. Construction Waste Management: Waste reduction progress reports and logs complying with the requirements of Section 01 74 19 "Construction Waste Management."
  - 2. Construction IAQ Management: See details below under Section 3.2 Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

#### **1.6 QUALITY ASSURANCE**

- A. Preconstruction Meeting: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner, Architect, and all Subcontractors to discuss the Construction Waste Management Plan, the required Construction Indoor Air Quality (IAQ) Management Plan, and all other Sustainable Design Requirements. The purpose of this meeting is to develop a mutual understanding of the

Project's Sustainable Design Requirements and coordination of the Contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.

- B. Construction Job Conferences: The status of compliance with the Sustainable Design Requirements of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.

## **PART 2 - PRODUCTS**

### **2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS**

- A. Site Clearing: Topsoil shall be provided by the Contractor from on-site material which has been stockpiled for reuse. Off-site borrow should only be used when on-site sources are exhausted. Chip and/or compost on site all vegetated material identified for removal.
- B. Do not burn rubbish, organic matter, etc. or any material on the site. Dispose of legally in accordance with Specifications Sections 01 74 19.
- C. Site Paving: All site impervious paving must be light colored, with a Solar Reflectance Index (SRI) of at least 29.
- D. Roofing Materials: All roofing systems, other than vegetated roof systems, must comply with the following requirements:
1. Low-Sloped roofing less than or equal to 2:12 slope must have an SRI of at least 78.
  2. Steep-Sloped roofing greater than 2:12 slope must have an SRI of at least 29.
  3. Roofing Materials: Light-colored, reflective, and high-emissivity roofing helps to reduce localized heat build-up from roof surfaces that contribute to the urban heat island effect.
- E. Exterior Lighting Fixtures:
1. All exterior luminaires must emit 0% of the total initial designed fixture lumens at an angle above 90° from nadir and/or meet the requirements of the Dark Sky certification program.
  2. Exterior lighting cannot exceed 80% of the lighting power densities defined by ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.
  3. No lighting of building facades or landscape features is permitted.

F. Water-Conserving Fixtures: Plumbing fixtures and fittings shall use in aggregate at least 20% less water than the water use baseline calculated for the building after meeting the Energy Policy Act of 1992 fixture performance requirements. Flow and flush rates shall not exceed the following:

1. Toilets: no more than 1.3 gallons per flush, otherwise be dual flush 1.6/0.8 gallons per flush, and have documented bowl evacuation capability per MaP testing of at least 400 grams
2. Urinals: Waterless or Water sense rated with no more than 0.5 gallons per flush.
3. Lavatory Faucets: 0.5 gpm with automatic faucet controls
4. Kitchen Sink Lavatories: 2.2 gpm
5. Showerheads: no more than 1.5gpm

G. Process Water Use: Employ strategies that in aggregate result in 20% less water use than the process water use baseline for the building after meeting the commercial equipment and HVAC performance requirements as listed in the Table below. For equipment not addressed by EPACT 2005 or the list below, additional equipment performance requirements may be proposed provided documentation supporting the proposed benchmark or industry standard is submitted.

1. Clothes Washer: 7.5 gallons/cubic foot/cycle
2. Dishwasher with Racks: 1.0 gallons/rack
3. Ice Machine: 20 gallons/100 pounds ice for machines making over 175 pounds of ice per day; 30 gallons/100 pounds ice for machines making less than 175 ice per day. Avoid water-cooled machines.
4. Food Steamer: 2 gallons/hour. Use only boilerless steamers.
5. Pre-Rinse Spray Valves: 1.4 gallons/minute
6. Kitchen Pot-Washing Sinks: 2.2 gallons/minute
7. Cooling Towers: 2.3 gallons/ton-hr. water loss

H. Elimination of CFCs AND HCFCs:

1. Ozone Protection and Greenhouse Gas Reduction: Base building cooling equipment shall contain no refrigerants other than the following: HCFC-123, HFC-134a, HFC-245fa, HFC-407c, or HFC 410a.

2. Fire suppression systems may not contain ozone-depleting substances.
  3. Extruded polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation shall not be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.
- I. Appliances and Equipment: All materials and equipment being installed that falls under the Energy Star or FEMP programs must be Energy Star or FEMP-rated. Eligible equipment includes refrigerators, motors, laundry equipment, office equipment and more. Refer to each program's website for a complete list.
- J. HVAC Distribution Efficiency:
1. All duct systems shall be constructed of aluminum, stainless steel or galvanized sheet metal, as deemed appropriate based on the application requirements. No fiberglass duct board shall be permitted.
  2. All medium- and high-pressure ductwork systems shall be pressure-tested in accordance with the current SMACNA standards.
  3. All ductwork shall be externally insulated. No interior duct liner shall be permitted.
  4. Where possible, all air terminal connections shall be hard-connected with sheet metal ductwork. If flexible ductwork is used, no flexible duct extension shall be more than six feet in length.
  5. All HVAC equipment shall be isolated from the ductwork system with flexible duct connectors to minimize the transmittance of vibration.
  6. All supply and return air branch ducts shall include the appropriate style of volume damper. Air terminal devices such as grilles, registers, and diffusers shall be balanced at duct branch dampers, not at terminal face.
- K. Measurement and Verification: Install controls and monitoring devices as required by MEP divisions order to comply with International Performance Measurement & Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003, Option D.
1. The IPMVP provides guidance on situation-appropriate application of measurement and verification strategies.



L. Salvaged or Reused materials: There shall be no substitutions for specified salvaged and reused materials and products.

1. Salvaged materials: Use of salvaged materials reduces impacts of disposal and manufacturing of replacements.

M. Recycled Content of Materials:

1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 30% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.

a. e post-consumer recycled content value of a material shall be determined by dividing the weight of post-consumer recycled content by the total weight of the material and multiplying by the cost of the material.

b. Do not include mechanical and electrical components in the calculations.

c. Do not include labor and delivery costs in the calculations.

d. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).

e. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.

f. The materials in the following list must contain the minimum recycled content indicated:

Category	Minimum Recycled Content
Compost/mulch	100% post-consumer
Asphaltic Concrete Paving	25% post-consumer
Cast-in-Place Concrete	6% pre-consumer
CMU: Gray Block	20% pre-consumer
Steel Reinforcing Bars	90% combined

Structural Steel Shapes	90% combined
Steel Joists	75% combined
Steel Deck	75% combined
Steel Fabrications	60% combined
Steel Studs	30% combined
Steel Roofing	30% post-consumer
Aluminum Fabrications	35% combined
Rigid Insulation	20% pre-consumer
Batt insulation	30% combined
<b>Category</b>	<b>Minimum Recycled Content</b>
Cellulose Insulation	90% combined
Rock Wool Insulation	75% pre-consumer
Fireproofing	20% combined
Steel Doors and Frames	35% combined
Gypsum Wallboard	100% combined
Carpet	40% combined
Ceramic Tile Flooring	60% combined
Rubber Flooring and Base	60% combined
Acoustical Ceiling Tile (ACT)	40% post-consumer
ACT Suspension System	90% post-consumer
Toilet Partitions	60% post-consumer

N. Regional Materials: Provide a minimum of 20 percent if building materials (by cost) that are manufactured and extracted/harvested within a 500 mile radius of the project site, exclusive of labor and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials within this specified 500 mile radius.

O. Biobased Products:

1. Use only biobased concrete form-release products.
2. Solid Wood Products: All new solid-wood-based materials will be certified as "FSC 100%" by an independent third party in accordance with FSC Forest Stewardship Council "Principles and Criteria" and will have received Chain-of-Custody Certification as certified by an

accredited certification group such as Smartwood or Scientific Certification Systems (SCS).

3. Other Wood Products: All other new wood-based materials will be certified by an independent third party in accordance with any of the following standards:
  - a. FSC: Forest Stewardship Council "Principles and Criteria" and has received Chain-of Custody Certification as certified by an accredited certification group such as Smartwood or Scientific Certification Systems (SCS).
4. Preservative-treated lumber with chromate copper arsenate (CCA) treatments is not permitted, and lumber with copper-based treatments (such as ACQ) is permitted only for ground-contact applications.
5. Wood-based materials include but are not limited to the following materials (when made from wood), engineered wood products, or wood-based panel products:
  - a. Rough carpentry
  - b. Miscellaneous carpentry
  - c. Heavy timber construction
  - d. Wood decking
  - e. Particleboard
  - f. Plywood
  - g. Metal-plate-connected wood trusses
  - h. Structural glued-laminated timber
  - i. Finish carpentry
  - j. Architectural woodwork
  - k. Wood paneling
  - l. Wood veneer wall covering
  - m. Wood flooring
  - n. Wood lockers
  - o. Wood cabinets
  - p. Wood doors
  - q. Non-rented temporary construction, including bracing, concrete formwork, pedestrian barriers, and temporary protection
- P. Brominated Flame Retardants: For new furniture, do not utilize cushioned office seating, and for lounge seating, do not utilize cushioned seating with brominated flame retardants.

Q. Outdoor Air Delivery Monitoring:

1. All spaces with an occupant density greater than 1 person per 40 square feet must include at least one CO2 monitor located between 3 feet and 6 feet above the finished floor.
2. All spaces with occupant density less than 1 person per 40 square feet must include a direct outdoor airflow monitor, capable of measuring the minimum outdoor airflow rate within 15% accuracy.
3. Monitoring equipment must be configured to generate a building automation system alarm and a visual or audible alert when CO2 concentrations vary by 10% or more from set point.

R. Adhesives and Sealants:

1. All adhesives and sealants used inside the building's thermal envelope must be third-party certified under one of the following programs:
  - a. Indoor Advantage Plus from Scientific Certification Systems, Inc.
  - b. Greenguard Children and Schools from Greenguard Environmental Institute
  - c. Collaborative for High Performance Schools
2. All adhesives and sealants, regardless of where they are used, must comply with the following limits for VOC content when calculated according to 40 CFR 49, Subpart D (EPA method 24):
  - a. Concrete Curing Compound: 60 g/L
  - b. Concrete Sealer: 10 g/L
  - c. Concrete Form Release Agents: 0 g/L
  - d. Garage Deck Sealer: 50 g/L
  - e. Wood Glues: 20 g/L
  - f. Millwork and Casework Adhesives: 20 g/L
  - g. Metal to Metal Adhesives: 30 g/L
  - h. Adhesives for Porous Materials (Except Wood): 50 g/L
  - i. Subfloor Adhesives: 50 g/L
  - j. Plastic Foam Adhesives: 50 g/L
  - k. Carpet Adhesives: 50 g/L
  - l. Carpet Pad Adhesives: 50 g/L
  - m. Carpet Seam Sealer: 50 g/L
  - n. VCT and Sheet Vinyl Adhesives: 50 g/L

- o. Cove Base Adhesives: 50 g/L
  - p. Rubber Floor Adhesives: 60 g/L
  - q. Wood Flooring Adhesives: 100 g/L
  - r. Ceramic Tile Adhesives: 65 g/L
  - s. Gypsum Board and Panel Adhesives: 50 g/L
  - t. Gypsum Drywall Joint Compound: 20 g/L
  - u. Portland Cement Plaster: 20 g/L
  - v. Multipurpose Construction Adhesives: 70 g/L
  - w. Cast Resin Countertop Silicone Sealant: 20 g/L
  - x. Plastic Laminate Adhesives: 20 g/L
  - y. General Contact Adhesive: 80 g/L
  - z. Structural Glazing Adhesives and Compounds: 100 g/L
  - aa. Silicone Sealant: 50 g/L
  - bb. Pipe Thread Sealant: 50 g/L
  - cc. Duct Sealant: 10 g/L
  - dd. Plastic Cement Welding Compounds: 250 g/L
  - ee. ABS Welding Compounds: 400 g/L
  - ff. CPVC Welding Compounds: 270 g/L
  - gg. PVC Welding Compounds: 150 g/L
  - hh. Adhesive Primer for Plastic: 250 g/L
  - ii. Architectural Sealants: 250 g/L
  - jj. Single-Ply Roofing Membrane Adhesives: 250 g/L
3. Interior sealants shall not contain: mercury, butyl rubber, neoprene, SBR (styrene Butadiene rubber), or nitrile.
4. Sealants and glazing compounds formulated with aromatic solvents (organic solvent with benzene ring in its molecular structure) fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, or their components shall not be used.
5. Adhesives used to apply laminates, whether shop-applied or field-applied, shall contain no urea-formaldehyde.

S. Paints and Coating:

1. Interior Paints and Coatings: for interior field-applied applications, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the chemical restrictions (Restricted components listed below) of Green Seal Standard GS-11, Paints, First Edition, May 20, 1993;

Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997; and South Coast Air Quality Management District Rule 1113, Architectural Coatings, rules in effect on January 1, 2004, as follows:

- a. Flat Paints and Coatings: Not more than 10 grams of VOC per liter of coating less water and exempt compounds, including pigments.
  - b. Non-Flat Paints and Coatings Except High Gloss: Not more than 50 grams of VOC per liter of coating less water and exempt compounds, including pigments.
  - c. High Gloss Paints and Coating: Not more than 150 grams of VOC per liter of coating less water and exempt compounds, including pigments. High Gloss Coatings are coatings that register a gloss 70 or above on a 60-degree meter according to ASTM Test Method D 523 as specified in paragraph (e) (6).
  - d. Water-Based Polychromatic Finish Coatings: Not more than 150 g/L (150 g/L for primer and flat polychromatic paint).
  - e. Anti-Corrosive Coatings: Not more than 100 grams of VOC per liter of coating less water and exempt compounds.
  - f. Sanding Sealers: Not more than 50 grams of VOC per liter of coating less water and exempt compounds.
  - g. Waterproofing Sealers: Not more than 100 grams of VOC per liter of coating less water and exempt compounds.
  - h. Concrete Slab Sealers: Not more than 10 grams of VOC per liter of coating less water and exempt compounds.
  - i. polyurethanes: Not more than 100 grams of VOC per liter of coating less water and exempt compounds.
  - j. Stains: Not more than 250 grams of VOC per liter of coating less water and exempt compounds.
2. Interior field applied varnishes and lacquers are not permitted.
  3. Interior paint shall not contain antimicrobial additives (such as fungicides and biocides).
  4. Exterior Paints and Coatings: For exterior application, use paints and coating that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the

chemical restrictions (Restricted Components listed below) of Green Seal's Standard GS-11:

- a. Flat Paints and Coatings: Not more than 50 grams of VOC per liter of coating less water and exempt compounds, including pigments.
  - b. Non-Flat Paints and Coatings: Not more than 150 grams of VOC per liter of coating less water and exempt compounds, including pigments.
  - c. High Gloss Paints and Coating: Not more than 150 grams of VOC per liter of coating less water and exempt compounds, including pigments. High Gloss Coatings are coatings that register a gloss 70 or above on a 60-degree meter according to ASTM Test Method D 523 as specified in paragraph (e) (6).
  - d. Anti-Corrosive Coatings: Not more than 100 grams of VOC per liter of coating less water and exempt compounds.
  - e. Varnishes and Sanding Sealers: Not more than 275 grams of VOC per liter of coating less water and exempt compounds.
  - f. Stains: Not more than 250 grams of VOC per liter of coating less water and exempt compounds.
5. Aromatic Compounds: Paints and coatings shall not contain more than 1% (by weight) total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
  6. Restricted Components: Paints and coating shall not contain any of the following:
    - a. Acrolein
    - b. Acrylonitrile
    - c. Analine Dyes
    - d. Antimony
    - e. Benzene
    - f. Butyl benzyl phthalate
    - g. Cadmium
    - h. Di (2-ethylhexyl) phthalate
    - i. Di-n-butyl phthalate
    - j. Di-n-octyl phthalate
    - k. 1,2-dichlorobenzene
    - l. Diethyl phthalate

- m. Dimethyl phthalate
- n. Ethylbenzene
- o. Formaldehyde
- p. Hexavalent chromium
- q. Isophorone
- r. lead
- s. Mercury
- t. Methyl ethyl ketone
- u. Methyl isobutyl ketone
- v. Methylene chloride
- w. Naphthalene
- x. Toluene (methylbenzene)
- y. 1,1,1-trichloroethane
- z. Vinyl chloride
- aa. Xylene

7. Coordinate with paint manufacturers for implementing a "take-back program" for all unused paint. Set aside scrap and unused paint to be returned to the manufacturer for recycling into new product. Close and seal all partially used containers of paint to maintain quality as necessary for reuse.

T. Floorcoverings:

1. Carpet shall achieve an Environmental Performance Score of 0.0200 as determined through an assessment in the Building for Environmental and Economic Sustainability (BEES) software model, either Version 3.0 or 4.0. The parameters of the model must be set in the following way for this assessment:
  - a. "Environmental vs. Economics Performance Weights" shall be set at 100% Environmental Performance.
  - b. "Environmental Impact Category Weights" shall be set using the EPA Scientific Advisory Board weights.
  - c. "Transportation from Manufacture to Use" shall be set at the lowest distance possible.
  - d. In the "Nylon Carpet Parameters" dialogue box, set "Carpet Type" as "Carpet Tile" and "Installation Glue" as "Low VOC Glue".



2. All carpet systems, including adhesives, must meet or exceed the Carpet and Rug Institute Green Label Plus Indoor Air Quality Test Program.
  3. Carpet cushion shall not contain brominated flame retardants.
  4. Carpet tile applications shall be self-adhering.
  5. All resilient floorcovering must be certified under the Greenguard or FloorScore indoor emissions testing programs.
  6. Engineered wood flooring and bamboo flooring must be certified under the Greenguard or FloorScore indoor emissions testing programs.
- U. Composite Wood and Agrifiber Binders: All composite wood, agrifiber products, and wood doors shall contain no added urea-formaldehyde resins.
- V. Systems Furniture and Seating:
1. All systems furniture and seating meet the requirements of one of the following:
    - a. Greenguard certification
    - b. SCS Indoor Advantage certification
    - c. SCS Indoor Advantage Gold certification
    - d. BIFMA Standard X7.1-2005, as tested to BIFMA method M7.1-2005 and as verified by an independent laboratory.
    - e. Calculated indoor air concentration limits for furniture systems and seating determined by the U.S. EPA's Environmental Technology Verification Large Chamber Test Protocol for Measuring Emissions of VOCs and Aldehydes (September 1999) testing protocol as conducted in an independent air quality testing laboratory.
  2. Systems furniture and seating made with coating or sealants that contain any of the following solvents are not permitted: naphtha, benzene, toluene, xylene, hexavalent chromium.
- W. Entryway Systems: Walk-off systems to capture particulates shall be installed at least 12 feet long in the direction of the entry travel at all entryways directly connected to the outdoors that are used as regular entry points by building users. Acceptable entryway systems include:
1. Permanently installed grates, grilles, or slotted systems that allow for cleaning beneath them.
  2. Permanently installed direct glue-down walk-off mats.

3. Non-permanent roll-out mats, but only if a service organization is contracted for maintenance on a weekly basis.
- X. Air Filtration: Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 13 or better in all air handling units for processing both return and outside air that is delivered to the air supply system. Replace all filtration media after the completion of construction and prior to occupancy.
- Y. Mercury in Lighting:
  1. Provide only low-mercury fluorescent or HID lamps with mercury content limited to the following:
    - a. T-5 and T-8 fluorescent lamps: 80 picograms per lumen hour.
  2. Measurement Standards: Lumens to be measured according to IES LM9 for linear fluorescent lamps, IES LM66 for compact fluorescent lamps, and LM51 for HID lamps; mercury content to be measured according to U.S. EPA "Total Mercury by Cold Vapor Absorption Method" 7471A.
- Z. Light Controls: Install and calibrate controls as specified by Division 26 - Electrical in order to comply with LEED IAQ lighting controllability requirements.
- AA. Thermal Comfort: Install and calibrate controls as specified in Division 23 - Heating, Ventilation, and Air-Conditioning.
- BB. Blended Cement Concrete:
  1. Cementitious Materials: Provide composite mix of Portland cement and ground granulated blast-furnace slag or fly ash or blended hydraulic cement and limit percentage (by weight) of portland cement (ASTM C150) in aggregate (total weighted average of cementitious material weight for all mixes and pours) to 40% less than standard regional concrete mix designs.
  2. Limit percentage (by weight) of standard portland cement (C-150), to the following maximum percentages of the cementitious portion of the mix while maintaining the above-40% required reduction in portland cement across the project's total quantity of concrete:
    - a. Footings: 50%
    - b. Slab on Grade: 60%, except for cold-weather pours
    - c. Insulated Concrete Form Concrete: 40%

- d. Elevated Slabs: 60%, except for cold-weather pours
  - e. Exterior Concrete: 75%
- CC. Gypsum Wallboard: Standard paper-faced gypsum wallboard can be used only in dry climates, where wetting during or after construction is not anticipated. In humid climates, where dampness and condensation are a concern, use only non-paper-faced gypsum wallboard. In wet locations a cementitious wallboard, made of portland or magnesium oxide cement, must be used.
- DD. Fiberglass Insulation: Fiberglass batt insulation shall contain no formaldehyde-based binders or shall be third-party certified for conformance with Greenguard Children & Schools of Indoor Advantage Gold.
- EE. Duct Acoustical Insulation: Mechanical sound insulation materials within the duct shall consist of an impervious, non-porous coating that prevents dust from accumulating in the insulating materials.
- FF. Green Housekeeping:
- 1. Utilize cleaning product that meet the requirements of the Green Seal GS-37 standard or comply with the requirements and maximum VOC limits of Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 8.5, Article 2, Regulation for Reducing VOC Emissions from Consumer Products (September 2001).
  - 2. Utilize janitorial paper products and trash bags that meet the minimum percentages of post-consumer recycled content and recovered content requirements of EPA's Comprehensive Procurement Guidelines.

### **PART 3 - EXECUTION**

#### **3.1 CONSTRUCTION WASTE MANAGEMENT**

- A. Develop and implement a Construction Waste Management Plan (CWMP), as defined in Section 01 74 19 "Construction Waste Management," quantifying material diversion by weight in order to recycle, reuse, and/or salvage at least 95% (by weight) of construction, demolition, and land-clearing waste.
- B. Clean material which are contaminated prior to placing in collection containers. Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

- C. Utilize any on-site existing paving materials that are scheduled for demolition as granulated fill or subbase material, and include the weight of this material in the calculations for material diverted from landfill disposal.
- D. Arrange for materials collection by or materials delivery to the appropriate recycling or reuse facility.
- E. Tax credits and other saving obtained or revenue generated for recycled or reused materials accrue to the Contractor.
- F. Discuss CWMP procedures and measures as an agenda item at all regular job meeting conducted during the course of work at the site, and record progress in meeting minutes.
- G. Submit monthly progress reports with Applications for Payment in accordance with Section 01 74 19 documenting the status of the CWMP and current diversion percentage rates.

### **3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT**

- A. Develop and implement a Construction IAQ Management Plan (CIAQMP) to prevent indoor air quality problems resulting from construction activities, including, at a minimum, the following:
  - 1. Construction activities must meet or exceed the minimum requirements of the SMACNA IAQ Guideline for Occupied Buildings under Construction, 1995.
  - 2. During construction, protect all absorptive materials stored on-site or installed from moisture damage as described in the Construction IAQ Management Plan (CIAQMP) defined above. Specifically:
    - a. Exercise special care at all times in the storage of materials to prevent exposure to moisture.
    - b. Avoid installation of gypsum wallboard and other porous materials until the building is weather-tight.
    - c. All standing water which accumulates on the interior floors shall be removed on the day that it is observed.
    - d. Any drywall that has retained more than 20% moisture after 48 hours following exposure to moisture, or that has evidence of mold, must be disposed of in accordance with Specification Section 01 74 19 "Construction Waste Management."

e. The contractor shall identify and remove all porous building materials that become wet or damaged by moisture within 7 calendar days of such exposure.

3. During construction and HVAC system installation, provide the Architect with photographs of IAQ management measures (such as protection of ducts and on-site or installed absorptive materials), including six photographs on three different occasions depicting implemented SMACNA approaches.

**B. Air Filtration:**

1. Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 13 or better in all air handling units for processing both return and outside air that is delivered to the air supply system; replace all filtration media after the completion of construction and prior to occupancy.

2. Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 8 or better for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction. Inspect weekly and replace as required.

C. Discuss CIAQMP procedures and measures as an agenda item at all regular job meetings conducted during the course of work at the site, and record progress in meeting minutes.

D. Engage an independent testing and inspecting agency to conduct a baseline indoor air quality testing program after the completion of construction and prior to occupancy in accordance with Section 01 81 09 "Testing for Indoor Air Quality" if applicable.

**3.3 COMMISSIONING**

A. Commissioning: All building energy-related systems and building envelope components shall be commissioned in accordance with the requirements of related commissioning sections in divisions in order to verify and ensure that fundamental building elements and systems are installed, constructed, calibrated to operate, and perform according to the Owner's Project Requirements, Basis of Design, and Construction Documents.

**3.4 MEASUREMENT & VERIFICATION**

A. For new construction, comply with the requirements of the International Performance Measurement & Verification Protocol (IPMVP), Volume III:

Concepts and Options for Determining Energy Savings in New Construction,  
April 2003, Option B or D.

- B. For existing building, comply with the requirements of the International  
Performance Measurement & Verification Protocol (IPMVP), Volume I:  
Concepts and Options for Determining Energy and Water Savings, 2001,  
Option B or D.

- - - E N D - - -

**SECTION 02 41 00**  
**DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies demolition and removal of selective building elements for alteration purposes.

**1.2 RELATED WORK:**

- A. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.
- E. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.8, INFECTION PREVENTION MEASURES.

**1.3 PROTECTION:**

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- D. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
  - 1. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for

- immediate use. Instruct all possible users in use of fire extinguishers.
2. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- E. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work.
1. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the COR.
2. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required.
3. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.
4. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have COR's approval.
- F. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.8 INFECTION PREVENTION MEASURES.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 DEMOLITION:**

- A. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center Property, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- B. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Coordinate with product representatives and manufacturers to determine acceptable material condition for recycling.



2. Dismantel existing construction and separate materials.
  3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- C. Drawings showing existing construction and utilizes are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as shown.
  2. Report discrepancies to Architect before disturbing existing installation.
- D. Separate areas in which demolition is being conducted from other areas that are still occupied; provide, erect, and maintain temporary dustproof partitions of construction in compliance with Section 01 00 00, GENERAL REQUIREMENTS.

### **3.2 CLEAN-UP:**

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to COR. Clean-up shall include off the Medical Center Property disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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**SECTION 05 50 00**  
**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.

1. Support for Wall and Ceiling Mounted Items.

**1.2 RELATED WORK**

A. Prime and finish painting: Section 09 91 00, PAINTING.

**1.3 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Ceiling hatchB. Shop Drawings:

1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.

**1.4 QUALITY ASSURANCE**

A. Assembled product to the greatest extent possible before delivery to the site.

B. 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 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):

B18.6.1-81(R1997) ..... Wood Screws

B18.2.2-87(R2005) ..... Square and Hex Nuts

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

A36/A36M-05..... Structural Steel

A123-02..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A307-07..... Carbon Steel Bolts and Studs, 60,000 PSI Tensile  
Strength

C1107-07..... Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

F436-07..... Hardened Steel Washers

F1667-05..... Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):

D1.1-04..... Structural Welding Code Steel

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Structural Steel Plates and Angles: ASTM A36.
- B. Structural Steel HSS Shapes: ASTM A 500 Gr. B
- C. Primer Paint: Manufacturer's Standard shop primer unless otherwise specified in Section 09 91 00, PAINTING.
- D. Grout: ASTM C1107, pourable type.

### **2.2 HARDWARE**

- A. Fasteners:
  - 1. Bolts with Nuts:
    - a. ASME B18.2.2.
    - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
  - 2. Washers: ASTM F436, type to suit material and anchorage.

### **2.3 FABRICATION GENERAL**

- A. Material
  - 1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
  - 2. Use material free of defects which could affect the appearance or service ability of the finished product.
- B. Connections
  - 1. Except as otherwise specified, connections may be made by welding, or bolting.
  - 2. Holes, for bolts: Accurately punched or drilled and burrs removed.

C. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.

D. Workmanship

1. General:

- a. Fabricate items to design shown.
- b. Furnish members in longest lengths commercially available within the limits shown and specified.
- c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
- d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
- e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
- f. Prepare members for the installation and fitting of hardware.
- g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
- h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:

- a. Weld in accordance with AWS.
- b. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
- c. Finish welded joints to match finish of adjacent surface.

3. Joining:

- a. Miter or butt members at corners.

- b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.

4. Cutting and Fitting:

- a. Accurately cut, machine and fit joints, corners, copes, and miters.

E. Finish:

- 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.

- 2. Steel and Iron: NAAMM AMP 504.

- a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.

- b. Surfaces exposed in the finished work:

- 1) Finish smooth rough surfaces and remove projections.
- 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.

- c. Shop Prime Painting:

- 1) Surfaces of Ferrous metal:

- a) Items not specified to have other coatings.
- b) Galvanized surfaces specified to have prime paint.
- c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
- d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
- e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

- 2) Non ferrous metals: Comply with MAAMM-500 series.

F. Protection:

- 1. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

**2.4 SUPPORTS FOR WALL AND CEILING MOUNTED ITEMS**

A. General:

- 1. Fabricate ASTM A36, and A500 Gr. B structural steel shapes as shown.
- 2. Use clip angles or make provisions for welding hangers and braces to overhead construction.

3. Field connections may be welded or bolted.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION, GENERAL**

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Field weld in accordance with AWS.
  1. Design and finish as specified for shop welding.
  2. Use continuous weld unless specified otherwise.
- C. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

#### **3.2 INSTALLATION OF SUPPORTS**

- A. Anchorage to structure.
  1. Secure to overhead structural steel by continuous welding unless otherwise shown.
  2. Secure to concrete when inserts do not exist with expansion bolts unless shown otherwise.
  3. Secure steel plate or hat channels to studs as detailed.
- B. Supports for Wall and Ceiling Mounted items:
  1. Locate center of support at anchorage point of supported item.
  2. Locate supports where required for items shown.

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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. Sealants and application: Section 07 92 00, JOINT SEALANTS.

**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):
  - E84-10..... Surface Burning Characteristics of Building Materials
  - E814-11..... 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
  - 1479-10..... 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<sup>2</sup> (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.

#### **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 COR.
- 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. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING

**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. 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 32° C (90° F) or less than 5° C (40° 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.

C612-10..... Mineral Fiber Block and Board Thermal Insulation.

C717-10..... Standard Terminology of Building Seals and Sealants.

C834-10..... Latex Sealants.

C919-08..... Use of Sealants in Acoustical Applications.

C920-10..... Elastomeric Joint Sealants.

C1021-08..... Laboratories Engaged in Testing of Building Sealants.

C1193-09..... 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.

E84-09..... Surface Burning Characteristics of Building Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).

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#### **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-4:

1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

C. 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.

**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. Caulking shall match adjacent finished surfaces.

**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 POURIOUS SURFACES:**

A. 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.
  - . 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.

**3.6 FIELD QUALITY CONTROL:**

- A. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified 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 Masonry or Stone: Type S-1
  2. Masonry to Masonry or Stone: Type S-1
- B. Interior Caulking:
1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2.

- - - E N D - - -

**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 05 - METALS, Division 22 - PLUMBING, and Division 26 - ELECTRICAL sections.

**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. Attach labels to panel stating the following:
  - a. Federal Specification Number or manufacturers name and product number of paints used.
  - b. Product type and color.

- c. Name of project.
- 4. 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 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-2008.... Threshold Limit Values (TLV) for Chemical  
Substances and Physical Agents and Biological  
Exposure Indices (BEIs)

ACGIH TLV-DOC-2008..... Documentation of Threshold Limit Values and  
Biological Exposure Indices, (Seventh Edition)

C. American National Standards Institute (ANSI):

A13.1-07..... Scheme for the Identification of Piping Systems

D. Master Painters Institute (MPI):

No. 45-07..... Interior Primer Sealer

No. 46-07..... Interior Enamel Undercoat

No. 47-07..... Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)

No. 50-07..... Interior Latex Primer Sealer

No. 52-07..... Interior Latex, MPI Gloss Level 3 (LE)

No. 53-07..... Interior Latex, Flat, MPI Gloss Level 1 (LE)

No. 54-07..... Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)

No. 60-07..... Interior/Exterior Latex Porch & Floor Paint, Low  
Gloss

No. 139-07..... Interior High Performance Latex, MPI Gloss Level 3  
(LL)

No. 141-07..... Interior High Performance Latex (SG) MPI Gloss  
Level 5

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURER**

Sherwin Williams, ProMar 200 Zero VOC Latex or approved equal.

### **2.2 MATERIALS**

A. Interior Primer Sealer: MPI 45.

B. Interior Enamel Undercoat: MPI 47.

C. Interior Latex Primer Sealer: MPI 50.

D. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.

E. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.

F. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.

G. Interior/ Exterior Latex Porch & Floor Paint, Low Gloss: MPI 60.

H. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.

I. Interior High Performance Latex (SG), MPI Gloss Level 5: MPI 141.

### **2.3 PAINT PROPERTIES**

- A. Use ready-mixed (including colors).
- 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.

### **2.4 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.
  - 2. Asbestos: Materials shall not contain asbestos.
  - 3. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
  - 4. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
  - 5. Use high performance acrylic paints in place of alkyd paints, where possible.
  - 6. 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.

**3.2 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. 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).
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, 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.

D. Copper and Copper Alloys

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non- Cementitious Galvanized Primer) depending on finish coat compatibility.

**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. 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 Contracting Officer's Technical Representative (COR).
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush or roller. Spray application is prohibited.

### **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.
- D Metals except boilers, incinerator stacks, and engine exhaust pipes:
  - 1. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
- E. Concrete Floors: MPI 60 (Interior/ Exterior Latex Porch & Floor Paint, Low Gloss).

### **3.6 INTERIOR FINISHES**

- A. Apply following finish coats over prime coats in spaces or on surfaces specified.
- 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.
    - b. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).
- C. Concrete Floors: One coat of MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss (FE)).

2. Interstitial floor markings: One coat MPI 60 (interior/ Exterior Latex Porch & Floor Paint, Low Gloss (FR)).

### **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. 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.
- B. 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.
- C. Paint Schedule:
  1. VA Standard P-1 (Walls - Typical): Benjamin Moore, Eco Spec (Zero VOC), Color: Mist Grey, No. 962 or match existing.

### **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 22 - PLUMBING and Division 26 - ELECTRICAL.
- 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 to match surrounding surfaces.
- I. Apply paint systems on properly prepared and primed surface as follows:
  - 1. 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) Plumbing equipment, and machinery having shop prime coat and not factory finished.

### **3.10 BUILDING AND STRUCTURAL WORK FIELD PAINTING**

- A. Painting and finishing of interior and exterior work except as specified under paragraph 3.10B.

1. Painting and finishing of new and existing work
2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
3. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Concealed surfaces:
  - a. Inside pipe basements, crawl spaces, pipe tunnels, except as otherwise specified.
  - b. Surfaces concealed behind permanently installed casework and equipment.
2. Moving and operating parts:
  - a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
3. 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.
4. Gaskets.

**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:

	COLOR OF	COLOR OF	COLOR OF	LEGEND
PIPING	EXPOSED PIPING	BACKGROUND	LETTERS	ABBREVIATIONS
Drain Line		Green	White	Drain
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret

7. See Sections for methods of identification, legends, and abbreviations of the following:

- b. Medical Gases and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.

### 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.

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**SECTION 22 05 11**  
**COMMON WORK RESULTS FOR PLUMBING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section shall 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 07 84 00, FIRESTOPPING.
- E. Section 07 92 00, JOINT SEALANTS.
- F. Section 09 91 00, PAINTING.
- G. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
- H. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS
- I. Section 26 29 11, 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.
  - 2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (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. 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 shall be submitted for project record and inserted into the operations and maintenance manual.

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. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Contracting Officers Technical Representative (COR).
  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.
  4. All welds shall be stamped according to the provisions of the American Welding Society.
- 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 COR 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. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and specifications shall be referred to the COR for resolution. Written hard copies or computer files of manufacturer's installation instructions shall be provided to the COR at least two weeks prior to commencing installation of any item.
  2. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved.
- E. Guaranty: Warranty of Construction, FAR clause 52.246-21.
- F. Plumbing Systems: IPC, International Plumbing Code.

#### **1.4 SUBMITTALS**

- A. Submittals shall be submitted 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, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.
- 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, lists of previous installations for selected items of equipment shall be provided. Contact persons who will serve as references, with telephone numbers and e-mail addresses shall be submitted with the references.
- G. Manufacturer's Literature and Data: Manufacturer's literature shall be submitted under the pertinent section rather than under this section.
  - 1. Electric motor data and variable speed drive data shall be submitted 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: Complete consolidated and coordinated layout drawings shall be submitted 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. All valves, trap primer valves, water hammer arrestors, strainers, and equipment requiring service shall be provided with an access door sized for the complete removal of plumbing device, component, or equipment. Equipment foundations shall not be installed until equipment or piping until layout drawings have been

approved. Detailed layout drawings shall be provided for all piping systems. In addition, details of the following shall be provided.

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. Listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided.
3. The listing shall include 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. Damaged equipment shall be replaced with an identical unit as determined and directed by the RE/COR. Such replacement shall be at no additional cost to the Government.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned 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. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC), latest edition. All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
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 shall 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-2007..... Boiler and Pressure Vessel Code; Section IX,  
Welding and Brazing Qualifications.
- C. American Society for Testing and Materials (ASTM):  
  
A36/A36M-2008..... Standard Specification for Carbon Structural Steel  
A575-96 (R 2007) ..... Standard Specification for Steel Bars, Carbon,  
Merchant Quality, M-Grades R (2002)  
  
E84-2005..... Standard Test Method for Surface Burning  
Characteristics of Building Materials  
  
E119-2008a..... Standard Test Methods for Fire Tests of Building  
Construction and Materials
- D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:  
  
SP-58-02..... Pipe Hangers and Supports-Materials, Design and  
Manufacture

SP 69-2003 (R 2004) .... Pipe Hangers and Supports-Selection and  
Application

E. National Electrical Manufacturers Association (NEMA):

MG1-2003, Rev. 1-2007.. Motors and Generators

C. International Code Council, (ICC):

IBC-06, (R 2007) ..... International Building Code

IPC-06, (R 2007) ..... International Plumbing Code

## **PART 2 - PRODUCTS**

### **2.1 FACTORY-ASSEMBLED PRODUCTS**

A. STANDARDIZATION OF COMPONENTS SHALL BE MAXIMIZED 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, shall be the same make and model

### **2.2 COMPATIBILITY OF RELATED EQUIPMENT**

A. 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 system that conforms to contract requirements.

### **2.3 SAFETY GUARDS**

- A. 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.
- B. All Equipment shall have moving parts protected from personal injury.

### **2.4 LIFTING ATTACHMENTS**

Equipment shall be provided 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). All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided. Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall have 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, and 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° C (160° 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. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.
- 4. Motor sizes shall be selected 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 or Premium Efficiency" by the project specifications on driven equipment, shall conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. 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 or premium efficient" 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. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.
- F. Rating: Rating shall be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation shall not exceed nameplate rating without service factor.
- G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.

## **2.6 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or 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 shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, fans, etc. shall be identified.
- 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: All temperature, pressure, and controllers shall be labeled and the component's function identified. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (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: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. A copy of the valve list shall be mounted in picture frames for mounting to a wall.
  4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling.

## **2.8 FIRE STOPPING**

- A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

## **2.9 GALVANIZED REPAIR COMPOUND**

- A. Military Specification DOD-P-21035B, paint.

## **2.10 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 International Building Code (IBC), latest edition. Submittals based on the International Building Code (IBC), latest edition 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. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the COR in all cases. See these specifications 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 (4 inches) thick when approved by the COR for each job condition.
  3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (4 inches) thick when approved by the COR 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 23 mm (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.



H. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Trapeze hangers are 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 13 mm (1/2-inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

I. 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 insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated 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.
- 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 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. //
  - j. Spring hangers are required on all plumbing system pumps one horsepower and greater.
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.
- J. 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 cold water shall have insulation that extends a minimum of one inch past the sheet metal.
  - b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields shall 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.

## **2.11 PIPE PENETRATIONS**

- A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- B. Pipe penetration sleeve materials shall comply with all fire stopping requirements for each penetration.
- C. To prevent accidental liquid spills from passing to a lower level, provide the following:
  1. For sleeves: Extend sleeve 25 mm (1 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 COR.
- D. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- G. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.
- H. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe.

Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. 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 07 92 00, JOINT SEALANTS.

## **2.12 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the COR, 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: metal, permanently identified for intended service and mounted, or located, where directed by the COR.
- D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

## **2.13 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. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

## **2.14 ASBESTOS**

Materials containing asbestos are not permitted.

## **PART 3 - EXECUTION**

### **3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING**

- A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping,

sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

- B. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged 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. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.
- C. Structural systems necessary for pipe and equipment support shall be coordinated 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. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.
  - 2. Holes shall be located 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 COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
  - 3. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.

- 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 COR. Damaged or defective items in the opinion of the COR, 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. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. shall be used for all pad or floor mounted equipment. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned 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. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.
- L. 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 cause the least interfere with normal operation of the facility.
- 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 electrical conduit, 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 may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.
- 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 Paragraph 3.1 shall apply.
- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

### **3.3 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. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the -COR.

- B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.
- C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work shall be provided.
- D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC), latest edition, and these specifications.
- 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. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
  - 2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. 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 grout material to permit alignment and realignment.



### **3.5 LUBRICATION**

- A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.
- B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to COR in unopened containers that are properly identified as to application.
- C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.
- E. All lubrication points shall be extended to one side of the equipment.

### **3.6 PLUMBING SYSTEMS DEMOLITION**

- A. Rigging access, other than indicated on the drawings, shall be provided after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris shall be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
- B. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards. Inspections will be made by personnel of the VA Medical Center, and the Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

- C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed 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. Existing plumbing systems shall not be abandoned in place. Wherever possible, remove lines back to the source.
- 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 COR 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.

### **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. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.
  2. The following Material And Equipment shall NOT be painted::
    - 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 gages and thermometers.
  - j. Glass.
  - k. Name plates.
- 3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint obtained from manufacturer or computer matched.
  - 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. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this.

### **3.8 IDENTIFICATION SIGNS**

- A. Laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, shall be provided that designates equipment function, 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 shall be placed on factory built equipment.
- C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

### **3.9 STARTUP AND TEMPORARY OPERATION**

- A. Start up of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified

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, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.
- 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 such 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. The Operations and maintenance manuals shall be delivered to COR not less than 30 days prior to completion of a phase or final inspection.
- B. All new and temporary equipment and all elements of each assembly shall be included.
- C. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.
- D. Manufacturer's installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.
- E. Lubrication instructions, type and quantity of lubricant shall be included.
- F. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- G. Set points of all interlock devices shall be listed.

- H. Trouble-shooting guide for the control system troubleshooting guide shall be inserted into the Operations and Maintenance Manual.
- I. The combustion control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.
- J. Emergency procedures.

**3.12 INSTRUCTIONS TO VA PERSONNEL**

Instructions shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

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**SECTION 22 05 12**  
**GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section describes the general motor requirements for plumbing equipment.

**1.2 RELATED WORK:**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements common to more than one section of Division 26.
- B. 26 29 11, MOTOR STARTERS: Starters, control and protection of motors: Section

**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. Motor nameplate information shall be submitted including electrical ratings, dimensions, mounting details, materials, horsepower, power factor, current as a function of speed, current efficiency, speed as a function of load, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
    - 3. Motor parameters required for the determination of the Reed Critical Frequency of vertical hollow shaft motors shall be submitted.
  - C. Manuals:
    - 1. Companion copies of complete maintenance and operating manuals, including technical data sheets and application data shall be submitted simultaneously with the shop drawings.
  - D. Certification: Two weeks prior to final inspection, unless otherwise noted, four copies of the following certification shall be submitted to the Contracting Officers Technical Representative (COR).:

1. Certification shall be submitted stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

#### **1.4 APPLICABLE PUBLICATIONS:**

- A. The publications listed below (including amendments, addenda, revisions, supplements and errata) shall 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 1-07..... 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):  
  
70-08..... 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:
  2. Three phase:
    - a. Motors connected to 208-volt systems: 200 volts.
- C. Number of phases shall be as follows:
  2. Motors, 373 W (1/2 HP) and larger: 3 phase.
- 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. Electrical Design Requirements

1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of class B, 130° C (266° F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80° C (176° F).
3. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
4. Motors shall be suitable for full voltage starting, unless otherwise noted.

H. Mechanical Design Requirements

1. Bearings shall be rated for a minimum of 26,280 hours L-10 life at full load direct coupled, except vertical high thrust motors.
2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30% of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 0.15 inch per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. All external fasteners shall be corrosion resistant.
9. Grounding provisions shall be in the main terminal box.

- I. Additional requirements for specific motors, as indicated in other sections, shall also apply.



J. NEMA Premium Efficiency Electric Motors, Motor Efficiencies: All permanently wired polyphase motors of 746 Watts (1 Horsepower) 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 (one horsepower) 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				Minimum Efficiencies			
Open Drip-Proof				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%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%

Minimum Efficiencies				Minimum Efficiencies			
Open Drip-Proof				Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

K. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM. Power factor correction capacitors shall be installed unless the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION:**

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**

Megger all motors after installation, before start-up. All shall test free from grounds.

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**SECTION 22 62 00**  
**VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Central Laboratory and Healthcare Vacuum Systems: This section describes the labor, equipment, and services necessary for and incidental to the installation of piped medical vacuum systems and medical vacuum. Medical vacuum shall be installed started, tested, and ready for use. The scope of work shall include all necessary piping, fittings, valves, rough ins, gages, alarms including low voltage wiring, vacuum pumps, electric motors and starters, receivers, and all necessary parts, accessories, connections and equipment. B. The contractor shall provide all elements and accessories required for a complete system according to the most recent edition of NFPA 99C, Gas and Vacuum Systems.
- B. All necessary connections to owner furnished equipment shall be made as indicated on the documents. A separate construction isolation valve shall be made at the point of connection to an existing vacuum system.
- C. Electrical power and control wiring for vacuum pump(s), alarms wiring from equipment to alarm panels, and modular accessories associated with the system(s) shall be included.
- D. Pressure testing, cross connection testing and final testing per NFPA 99 most recent edition and using procedures shall be performed.F. The contractor shall retain a qualified third party medical vacuum verifier acceptable to the engineer and VA to perform and attest to final verification of the systems. The contractor shall make all corrections as determined by this third party verifier, including additional testing if necessary to attain full and unqualified certification.
- E. Coordinate with owner retained verifier for final verification of the systems. Make corrections as required, including additional testing if necessary to attain full and unqualified certification.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Sealing around pipe penetrations to maintain the integrity of time rated construction.
- B. Section 07 92 00, JOINT SEALANTS: Sealing around pipe penetrations through the floor to prevent moisture migration.

- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General requirements and items common to more than one section of Division 22.
- D. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT: Electric motors.
- E. SECTION 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES: Laboratory and Healthcare Gas Piping and Equipment:
- F. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Control wiring.
- G. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit.

### **1.3 QUALITY ASSURANCE**

- A. Installation and Start-up: The manufacturer will provide factory authorized representatives to review installation and perform initial start up of system.
- B. Contractor shall include with submittals an affidavit attesting to compliance with all relevant paragraphs of NFPA 99 most recent edition. Personnel assembling medical vacuum system shall meet NFPA 99 5.1.10.10.11 "Qualification of Installers" and hold medical gas endorsements as under ASSE 6010. The Contractor shall furnish documentation attesting that all installed piping materials were purchased cleaned and complied with the requirements of NFPA 99 5.1.10.1 and 5.1.10.2. Electrical Control systems and Medical vacuum Alarms are to be UL listed as assemblies with label affixed. Medical vacuum controls are to be wired in accordance with NEC.
- C. Equipment Installer: The equipment installer shall show documentation proving that the personnel installing the equipment meet the standards set by the American Society of Sanitary Engineers (ASSE) 6010 Professional Qualification Standards for Medical Gas System Installers. Show technical qualifications and previous experience in installing medical gas equipment on three similar projects. Submit names and addresses of referenced projects. The equipment install shall perform the following coordination functions:
  - 1. Coordinate with other trades to ensure timely installations and avoid conflicts and interferences.
  - 2. Work with the metal stud partition installer and/or mason to ensure anchors, sleeves and similar items are provided in sufficient time to avoid delays; chases and openings are properly sized and prepared.

3. All components to follow facility design standards.

4. The contractor shall coordinate with the Medical Vacuum System

Verifier to deliver a complete, tested medical gas installation ready for owner's use.

- D. Equipment Supplier: The Equipment supplier shall demonstrate evidence of installing equivalent product at three installations similar to this project that has been in satisfactory and efficient operation for three years. Names and addresses where the product is installed shall be submitted for verification.
- E. Medical Gas System Testing Organization: The Medical vacuum verifier shall show documentation proving that the medical gas verifier meet the standards set by the American Society of Sanitary Engineers (ASSE) 6010 Professional Qualification Standards for Medical Gas Ssystem Verifiers. The testing shall be conducted by a party technically competent and experienced in the field of medical gas pipeline testing. Such testing shall be performed by a party other than the installing contractor.
- F. Names of three projects where testing of vacuum systems has been performed by the testing agency shall be provided. The name of the project, names of such persons at that project who supervised the work for the project owner, or who accepted the report for the project owner, and a written statement that the projects listed required work of similar scope to that set forth in this specification shall be included in the documentation.
- G. The testing agency's detailed procedure which will be followed in the testing of this project shall be submitted. In the testing agency's procedure documentation, include details of the testing sequence, procedures for cross connection tests, outlet function tests, alarm tests, purity tests, etc., as required by this specification. For purity test procedures, data on test methods, types of equipment to be used, calibration sources and method references shall be submitted.
- H. Installation and Start-up: The manufacturer shall provide factory authorized representatives to review the installation and perform the initial startup of the system. The factory authorized representatives shall submit a report to the construction administrator and to the Contractor. The Contractor shall make all corrections identified by the factory authorized representative.

- I. Certification: The Final inspection documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits allowed by this specification.
- J. The installing contractor shall maintain as-built drawings of each completed phases for verification; and, shall provide the complete set at the time of final systems certification testing, for certification by the Third Party Testing Company. As-built drawings shall be provided, and a copy of them on Auto-Cad version (R-14 or later) provided on compact disk.

#### **1.4 SUBMITTALS**

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Complete specifications for the product intended to be installed, dimensional drawings, and wiring schematics.
  - 2. Package drawing indicating package style, dimensions when complete, method of disassembly and sizes of subsections for rigging and installation.
  - 3. Piping.
  - 4. Valves.
  - 5. Gages.
  - 6. Alarm controls and panels.
  - 7. Vacuum switches.
  - 8. Vacuum pump systems (Provide certified pump test data at start up):
    - a. Pumps: Manufacturer and model.
    - b. Pump performance curves.
    - c. Pump operating speed (RPM).
    - d. Capacity: Free air exhaust from 65 and 80 kPa (19 and 24 inches Hg.) gage vacuum (L/s) (SCFM).
    - e. Capacity: Expanded air capacity at 65 and 80 kPa (19 and 24 inches Hg.) gage vacuum (L/s) (SCFM).

- f. Type of bearing in pump.
  - g. Type of lubrication.
  - h. Type and adjustment of drive.
  - i. Electric motors: Manufacturer, frame and type.
  - j. Speed of motors (RPM).
  - k. Current characteristics and horsepower of motors.
  - l. Receiver capacity and rating.
  - m. Silencers: Manufacturer, type and model.
- C. Certification: The completed systems have been installed, tested, purged and analyzed in accordance with the requirements of this specification.
- D. A notarized affidavit from the verifier stating that the verifier undertakes to verify this project and thus agrees to disqualify themselves from supplying any equipment which will be included in the scope of their verification. No verifier who supplies equipment shall be permitted to verify that equipment. Statement declaring that the vacuum system manufacturer has no fiduciary interest in the verifier and that the verifier is not an agent or representative of the vacuum system manufacturer. Statement declaring that the contractor has no fiduciary interest in the third party verifier and that the third party verifier has no fiduciary interest in the contractor.
- 1.5 Training
- E. The services of a competent instructor shall be provided for not less than two four-hour periods for instructing personnel in the operation and maintenance of the vacuum systems, on the dates requested by COR.
- F. The other training requirements specified in Section 01 00 00, GENERAL REQUIREMENTS shall be coordinated with the above paragraph

#### **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 test by the basic designation only.
- B. American National Standards Institute (ANSI):
- A13.1-2007..... Scheme for Identification of Piping Systems
  - B16.22-01 (R2005) ..... Wrought Copper and Bronze Solder-Joint Pressure Fittings

- B40.1-(2006) ..... Pressure Gauges and Gauge Attachments
- C. American Society for Testing and Materials (ASTM):
  - B819-00 ..... Standard Specification for Seamless Copper Tube  
for Medical Gas Systems
- D. American Society of Mechanical Engineers (ASME):
  - Section IX-04 ..... Welding and Brazing Qualifications
- E. American Welding Society (AWS):
  - AWS A5.8/A5.8M-2004 .... Brazing Filler Metal
  - AWS B2.2-91 ..... Standard for Brazing Procedure and Performance  
Qualification (Modified per NFPA 99)
- F. Compressed Gas Association (CGA):
  - P-9-92 ..... Inert Gases Argon, Nitrogen and Helium
- G. National Electrical Manufacturers Association (NEMA):
  - ICS-6-(1993, R 2006) ... Industrial Controls and Systems Enclosures
- H. National Fire Protection Association (NFPA):
  - 70(2007) ..... National Electric Code
  - 99-2005 ..... Health Care Facilities with 2005 errata
- I. United States Pharmacopoeia XXI/National Formulary XVI (USP/NF)
- J. Manufacturing Standardization Society (MSS):
  - MSS-SP-72-99 ..... Ball Valves With Flanged or Butt Welding For  
General Purpose
  - MSS-SP-110-96 ..... Ball Valve Threaded, Socket Welding, Solder Joint,  
Grooved and Flared Ends
  - MSS-SP-73-03 ..... Brazing Joints for Copper and Copper Alloy Solder  
Pressure Fittings

#### 1.7 WARRANTY

- A. Warranty will be expressly complete, include all components of the system and be the responsibility of the vacuum system manufacturer of record only. Warranties limiting the responsibility of the vacuum system for any system component or which pass through to another manufacturer are not acceptable.



- B. Warranties shall include on site repairs including travel, labor and parts. Warranties requiring return of equipment for adjustment are not acceptable.

#### **1.8. MAINTENANCE SUPPORT**

- A. The medical vacuum equipment manufacturer shall demonstrate a national factory direct service capability able to perform major overhauls. The medical vacuum equipment manufacturer shall offer factory direct preventative maintenance contract for the owner's consideration. The medical vacuum equipment manufacturer shall offer formal maintenance training courses.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL PRODUCT REQUIREMENTS**

- A. One Medical Vacuum Equipment Manufacturer shall supply the medical vacuum system(s) and equipment to include valves and gauges, alarm panels, manifolds, medical air, instrument air, and vacuum sources.

#### **2.2 PIPING**

- A. Copper Tubing: Copper tubing shall be type "K" or "L", ASTM B819, seamless copper tube, hard drawn temper, with wrought copper fittings conforming to ANSI B16.22 or brazing fittings complying with MSS SP-73. The copper tubing size designated reflects nominal inside diameter. All tubing and fittings shall be labeled "ACR/OXY", "OXY", "OXY/MED", "ACR/MED", or "MED".
- B. Brazing Alloy: The brazing alloy shall comply with AWS A5.8, Classification BCuP, greater than 537 °C (1000 °F) melting temperature. Flux shall be strictly prohibited for copper to copper connections.
- C. Screw Joints: Screw joints shall use polytetrafluoroethylene (teflon) tape.
- D. Galvanized Steel: Galvanized steel shall only be used for the discharge from the vacuum producer. The galvanized steel vacuum discharge pipe and fittings shall comply with the following:
  - 1. Pipe: The galvanized steel pipe shall comply with ASTM A53, standard weight.
  - 2. Fittings: The fittings shall comply with the the following
    - a. Flexible groove, malleable iron, ASTM A47, or ductile iron, ASTM A536.

b. Malleable iron screwed, ANSI B16.3.

E. Memory metal couplings shall have temperature and pressure ratings not less than that of a brazed joint.

F. Piping identification labels shall be applied at time of installation in accordance with current NFPA. Supplementary color identification shall be in accordance with CGA Pamphlet C-9.

G. Special Fittings: The following special fittings shall be permitted to be used in lieu of brazed joints:

1. Memory-metal couplings having temperature and pressure ratings joints not less than that of a brazed joint.
2. Listed or approved metallic gas tube fittings that, when made up, provide a permanent joint having the mechanical, thermal, and sealing integrity of a brazed joint.
3. Dielectric fittings where required by the manufacturer of special medical equipment to electrically isolate the equipment from the piping distribution system.
4. Axially swaged, elastic strain preload fittings providing metal to metal seal having pressure and temperature ratings not less than that of a brazed joint and when complete are permanent and non-separable.

## **2.3 VALVES**

A. Ball: Ball valves shall be in line, other than zone valves in cabinets.

1. Sixty five millimeter or DN65 (2 1/2 inches) and smaller: Ball valves shall be bronze/ brass body, Fed. Spec. MSS SP72 & SP 110 , Type II, Class 150, Style 1, with tubing extensions for brazed connections, full ported, three piece or double union end connections, teflon seat seals, full flow, 4125 kPa (600 psi) WOG minimum working pressure, with locking type handle.
2. Eighty millimeter or DN80 to 100 millimeter or DN100 (3" to 4" inches): Ball valves shall be bronze/ brass body, Fed. Spec. MSS SP72 & SP 110, Type II, Class 150, Style 1 with tubing extensions brazed to flanges, full ported, three piece, double seal, teflon seals, full flow, 4125 kPa (600 psi) WOG minimum working pressure, with locking type handle.

B. Check:

1. Check valves eighty millimeters (DN80) (3 inches) and smaller: brass and Bronze body, straight through design for minimum pressure drop, spring loaded, self aligning with teflon cone seat, vibration free, silent operation, supplied NPT female threads at each end with flow direction arrow permanently cast into, 2750 kPa (400 psi) WOG minimum working pressure.

## **2.6 GAGES**

### **A. Vacuum Gages:**

1. For vacuum line adjacent to source equipment the vacuum gages shall comply with ANSI B40.1, vacuum gage type, size 115 mm (4-1/2 inches), gage listed for vacuum, accurate to within 2-1/2 percent, with metal case. The vacuum gage range shall be 0 to -100 kPa (0-30 inches Hg). Dial graduations and figures shall be black on a white background, or white on a black background. Label shall be for vacuum service. A gage cock shall be installed. Compound gages shall be installed for Vacuum system.
2. For vacuum service upstream of main shutoff valve: A 40 mm (1-1/2 inch) diameter gage shall be provided with steel case, bourdon tube and brass movement, dial range 0 to -100 kPa (0-30 inches Hg). Compound gages shall be provided for Vacuum system.

## **2.7 VACUUM SWITCHES**

- A. Vacuum switches shall be general purpose, contact or mercury type, allowing both high and low set points, with contact type provided with a protective dust cover. The vacuum switch shall have an adjustable range set by inside or outside adjustment. Vacuum switches shall activate when indicated by alarm requirements. One orifice nipple (or DISS demand check valve) shall be used for each sensor switch.

## **2.8 VACUUM PUMP SYSTEMS**

- A. Provide a complete medical vacuum package, complying with NFPA 99 5.1.3.6 in all respects, as specified and scheduled on the drawings. All components shall be factory packaged (pre-wired and prepiped), on a steel base, or tank mounted. All package piping shall be type L or type K rigid copper. Provide discharge separator/silencer.
- B. All components shall be duplexed and valved (or check valved as permitted NFPA-99) to allow service to any component without interrupting vacuum service to the facility during any maintenance operation or any condition

of single fault failure. The design load shall be met with the largest single unit out of service. Each pump exhaust shall be isolated by a union fitting permitting capping for service removal.

- C. A complete plant shall be furnished consisting of pumps, receiver and controls capable of providing the scheduled capacity with one pump out of service. All capacities will be indicated in SCFM at 19 inches HG and 24 inches HG.
- D. System shall be completely factory assembled, requiring only interconnection between modules on site. Systems requiring on site assembly other than interconnection are not acceptable (replacement of components removed for shipping is permitted).
- E. Motor and Starter: Maximum 40 °C (104 °F) ambient temperature rise, close coupled to a NEMA rated, High Efficiency, TEFC motor with a service factor of 1.15, ball bearings, for operation with current, voltage, phase and cycle specified in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT. Motor shall be of such capacity that brake horsepower required by driver equipment at normal rated capacity will not exceed nameplate rating of the motor. Provide each motor with automatic, fully enclosed, magnetic starter of type specified in Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.
- F. Each pump will include inlet and outlet flex connectors supplied by the medical vacuum equipment manufacturer.
- G. Programmable Logic Controllers (PLC) will be used to implement operating logic. PLC shall have integral memory and EPROM backup. PLC shall control the automatic alternation of the vacuum pumps with provisions for simultaneous operation if required, and automatic activation of reserve or lag unit if required. A lag alarm on control cabinet and contacts for the master alarm shall be provided.
- H. The complete control system and all electrical components shall be NEMA ICS-6, type 12 and UL labeled. The control system shall provide:
  - 1. Automatic lead/lag sequencing including self adjusting minimum run timers which adaptively optimize the number of pump starts based on demand.
  - 2. Circuit breaker disconnects for each vacuum pump with external operators. Units with fuses instead of circuit breakers in motor circuit are not acceptable. The control system shall include an

automatic minimum run time adjustment to automatically adjust run time based on demand.

3. Full voltage motor starters with overload protection.
  4. Redundant 120 volt control circuit transformers.
  5. Visual and audible reserve unit alarm with isolated contacts for remote alarms and audio cancel.
  6. Control cabinet shall have lighted HOA selector switches
  7. Panel mounted vacuum gauge, external visual lights indicating on/off status, audible and visual signals for thermal overload, oil discharge filter differential pressure or back pressure alarm, and alarm silence button.
  8. Contacts for external oil discharge filter differential pressure or back pressure alarm
  9. If silence has been pressed, audible and visual signal would be reactivated upon second alarm condition. Alarm shall be reset upon correction of original signal.
  10. Runtime hour-meter for each pump.
- I. The medical vacuum pumps shall be non contacting claw style rotary design. The internal construction shall be friction free and require no sealants. Each medical vacuum pump shall be air-cooled and continuous duty rated. Each medical vacuum pump shall be provided with a single lubricated gearbox required an oil change not more often than 5,000 operating hours. Each medical vacuum pump shall be equipped with an exhaust silencer. Each medical vacuum pump shall be equipped with a high vacuum shutdown, a high temperature shutdown, a remote alarm at the ECC and local alarms. The lubricant supplied shall be inert with oxygen and the medical vacuum pump shall be factory cleaned for oxygen service.
- J. The complete medical vacuum system and all electrical components shall be factory tested prior to shipment by the medical vacuum equipment manufacturer
- K. 1.Controls:
1. Automatic: Adjustable, vacuum operated, automatic, electric switch to start and stop motor at receiver vacuum indicated. Provide heavy duty

alternator, automatic, operating on a timed basis, to alternate the pumps by time forced alternation.

2. Control panel: Housed in a NEMA ICS-6, Type 12, listed, dust proof enclosure; prewired to include all specified electrical, and electronic devices. Include wiring diagrams and operating descriptions in the cabinet. Include the following:

- a. Circuit breakers for each control and motor circuit.
- b. Hand off automatic selector switch for each pump.
- c. Hour meter for each pump.
- d. Control circuit transformers.
- e. One magnetic motor starter for each pump.
- f. Provide panel with external visual (lights, red for running, green for off) and audible (horn/buzzer) signals. The signals provided include:
  - 1) Pump in operation (visual only).
  - 2) Thermal overload shutdown (visual and audible).
  - 3) Oil discharge filter differential pressure or back pressure alarm (visual), with contacts for external signal. Wire to master alarm panel.
  - 4) Cancel button, which will silence an audible alarm, reactivate should a second alarm occur while the horn is silenced, and reset automatically upon correction of the original signal.

Q. Receiver Tank: The receiver tank shall be welded galvanized steel, in compliance with ASME Section VIII, 850 kPa (125 psi) working pressure stamped and certified. The receiver tank shall be equipped with vacuum gage and gage glass. The receiver tank shall be of sufficient capacity to ensure practical on/off operation of pumps.

R. Bio-Hazard Safety Statement: "BIOHAZARD CAUTION: Fluid and waste material inside vacuum pipelines and vacuum equipment may be contaminated with blood and other potentially infectious material. Construction and service personnel should use PERSONAL PROTECTIVE EQUIPMENT and practice UNIVERSAL PRECAUTIONS when opening or servicing vacuum systems."

S. Manufacturer: Beacon Medaes, or equal.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. All installation shall be performed in strict accordance with NFPA 99 5.1.10. Brazing procedures shall be as detailed in NFPA 99 5.1.10.5. Brazing shall be performed only by brazers qualified under NFPA 99 5.1.10.10.11.
- B. Contractor shall furnish 4 inch high concrete housekeeping pads. The contractor shall furnish inertia bases in lieu of housekeeping pads where the equipment installed is not factory isolated by the manufacturer. Anchor bolts shall be cast into bases
- C. Open ends of tube shall be capped or plugged at all times or otherwise sealed until final assembly.
- D. Piping shall be cut square and accurately with a tube cutter (sawing not permitted) to measurements determined at place of installation. the tubing shall be reamed to remove burrs, being careful not to expand tube, and so no chips of copper remain in the tube. The tubing shall be worked into place without springing or forcing. The tubing shall be bottomed in socket so there are no gaps between tube and fitting. Care shall be exercised in handling equipment and tools used in cutting or reaming of tube to prevent oil or grease from being introduced into the tubing. Where contamination has occurred, material shall be no longer suitable for vacuum service and new, sealed tube sections used..
- E. Piping shall be supported with pipe trays or hangers at intervals as shown on the drawings or as defined in NFPA 99 Table 5.1.10.10.4.5. Piping shall not be supported by other piping. Isolation of copper piping from dissimilar metals shall be of a firm, positive nature. Duct tape is not acceptable as an isolation material..
- F. Valves and other equipment shall be rigidly supported to prevent strain on tube or joints.
- G. Piping exposed to physical damage shall be protected.
- H. During any brazing operation, the interior of the pipe shall be purged continuously with oil free, dry nitrogen NF, following the procedure in NFPA 99 5.1.10.5.5. At the completion of any section, all open pipe ends shall be capped using an EXTERNAL cap. The flow of purged gas shall be maintained until joint is cool to touch. The use of flux is prohibited when making of joints between copper to copper pipes and fittings.

- I Threaded joints in piping systems shall be avoided whenever possible. Where unavoidable, make up the male threads with polytetrafluoroethylene (such as Teflon) tape. Liquid sealants shall not be used.
- J. Tubing shall not be bent. Fittings shall be used in all change of direction or angle.
- K. After installation of the piping, but before installation of the outlet valves, blow lines clear using nitrogen NF.
- M. Pressure and vacuum switches, transmitter and gauges shall be installed to be easily accessed. Pressure switch and sensors shall be installed with orifice nipple between the pipe line and switches/sensors.
- L. Pipe labeling shall be applied during installation process and not after installation is completed. Size of legend letters shall be in accordance with ANSI A13.1.
- M. After initial leakage testing is completed, the piping shall be allowed to remain pressurized with testing gas until testing agency performs final tests.
- N. Penetrations:
  - 1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoked partitions, or floors, fire stopping shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, Clearances between raceways and openings with the fire stopping material shall be completely filled and sealed..
  - 2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and made watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- P. Piping shall be labeled with name of service, identification color and direction of flow. Where non-standard pressures are piped, pressure shall be labeled. Labels shall be placed at least once every 20 feet of linear run or once in each story (whichever is more frequent). A label shall additionally be placed immediately on each side of all wall or floor penetrations. Pipe labels shall be self adhesive vinyl type or other water resistant material with permanent adhesive colored in accordance with NFPA 99 Table 5.1.11 and shall be visible on all sides of the pipe.



Each master alarm signal shall be labeled for function after ring out.  
Labels shall be permanent and of a type approved by the VAMC

- Q. Alarms and valves shall be labeled for service and areas monitored or controlled. Coordinate with the VAMC for final room or area designations. Valves shall be labeled with name and identification color of the gas and direction of flow

### **3.2 INSTALLER TESTING**

- A. Prior to declaring the lines ready for final verification, the installing contractor shall strictly follow the procedures for verification as described in NFPA 99 5.1.12.2 and attest in writing over the notarized signature of an officer of the installing company the following;
1. That all brazing was conducted by brazers qualified to ASSE 6010 and holding current medical gas endorsements.
  2. That all brazing was conducted with nitrogen purging. (Procedure per NFPA 99 5.1.10.5.5).
  3. That the lines have been blown clear of any construction debris using oil free dry nitrogen or air are clean and ready for use. (Procedure per NFPA 99 5.1.12.2.2).
  4. That the assembled piping, prior to the installation of any devices, maintained a test pressure 1 1/2 times the standard pressures listed in NFPA 99 Table 5.1.11 without leaks. (Procedure per NFPA 99 5.1.12.2.3).
  5. That after installation of all devices, the pipeline was proven leak free for 24hours at a pressure 20% above the standard pressures listed in NFPA 99 Table 5.1.11. (Procedure per NFPA 99 5.1.12.2.2.6)
  6. That the systems have been checked for cross connections and none were found. (Procedure per NFPA 99 5.1.12.2.4)
  7. That the manufacturer has started up all medical air compressors, medical vacuum pumps WAGD producers, liquid oxygen system(s) and manifolds, and that they are in operating order.
- B. Four originals of the affidavit, shall be distributed; (1) to the engineer, (1) to the owners representative, (1) to the general contractor and (1) to the verifier.

### 3.3 VERIFIER TESTING

A. Prior to handing over the systems to VAMC, the contractor shall retain a Verifier acceptable to the engineer and owner who shall follow strictly the procedures for verification as described in NFPA 99 5.1.12.3 and provide a written report and certificate bearing the notarized signature of an officer of the verification company which contains at least the following:

1. A current ACORD insurance certificate indicating professional liability coverage in the minimum amount of \$1 Million per occurrence, and general aggregate liability in the minimum amount of \$1 Million, valid and in force when the project is to be verified. General liability insurance is not alone acceptable.
2. An affidavit bearing the notarized signature of an officer of the verification company stating that the verification company is not the supplier of any equipment used on this project or tested in this report and that the verification contractor has no relationship to, or pecuniary interest in, the manufacturer, seller, or installer of any equipment used on this project or tested in this report
3. A listing of all tests performed, listing each source, outlet, valve and alarm included in the testing.
4. An assertion that all tests were performed by a Medical Vacuum System Certified Medical Gas or vacuum Verifier or by individuals qualified to perform the work and holding valid qualifications to ASSE 6030 and under the immediate supervision a Verifier. Include the names, credential numbers and expiration dates for all individuals working on the project.
5. A statement that equipment used was calibrated at least within the last six months by a method traceable to a National Bureau of Standard Reference and enclosing certificates or other evidence of such calibration(s). Where outside laboratories are used in lieu of on site equipment, those laboratories shall be named and their original reports enclosed.
6. A statement that where and when needed, equipment was re calibrated during the verification process and describing the method(s) used.
7. A statement that the systems were tested and found to be free of debris to a procedure per NFPA 99 5.1.12.3.7.

8. The flow from each outlet when tested to a procedure per NFPA 99-5.1.12.3.10.
  9. A statement that the systems were tested and found to have no cross-connections to a procedure per NFPA 99 5.1.12.3.3.
  10. A statement that the systems were tested and found to be free of contaminants to a procedure per NFPA 99 5.1.12.3.8 except that the purity standard shall be 2 ppm difference for halogenated hydrocarbons and 1 ppm total hydrocarbons (as methane).
  11. Statement that all local signals function as required under NFPA 99 5.1.3.4.7 and as per the relevant NFPA 99 sections relating to the sources.
  12. A listing of local alarms, their function and activation per NFPA 99 5.1.12.3.14.
  13. A listing of master alarms, their function and activation, including pressures for high and low alarms per NFPA 99 5.1.12.3.5.2.
  14. A statement that the sources include all alarms required by NFPA 99 Table A.5.1.9.5.
  15. The concentration of each component of NFPA 99 Table 5.1.12.3.12 in the medical air after 24hours of operation of the medical air source.
  16. The concentration of each gas at each outlet as specified in NFPA 99 5.1.12.3.11.
  17. A statement that all valves and alarms are accurately labeled as to zone of control.
  18. Provide four originals of this affidavit, and report, distributed; (1) to the engineer, (1) to the owner's representative, (1) to the general contractor and (1) to the installing contractor.
- B. Perform and document all cross connection tests, labeling verification, supply system operation, and valve and alarm operation tests as required by, and in accordance with, current NFPA and the procedures set forth in pre-qualification documentation.
- C. Verify that the systems, as installed, meet or exceed the requirements of current NFPA, this specification, and that the systems operate as required.

- D. Piping purge test: For each positive pressure gas system, verify cleanliness of piping system. Filter a minimum of 35 cubic feet (1000 liters) of gas through a clean white 0.45 micron filter at a minimum velocity of 3.5 scfm (100 Lpm). Filter shall show no discoloration, and shall accrue no more than 0.1 mg of matter. Test each zone at the outlet most remote from the source. Perform test with the use of an inert gas as described in CGA P-9.

**3.4 CONNECTION TO EXISTING HEALTHCARE VACUUM SYSTEM:**

- A. Contactor shall test the existing system for hydrocarbons, dew point, etc. If problems are present, the COR would notify the facility of the results. The facility would then make the necessary repairs and/ or maintenance.
- B. Double Shut-off valves shall be installed at the connection of new line to existing line.
- C. Time for shut-down of the existing vacuum system shall be coordinated with the VA medical center.
- D. Prior to any work being done, new pipeline shall be checked for particulate or other forms of contamination.
- E. Insure that the correct type of pipe tubing and fittings are being used.
- F. A spot check of the existing pipelines shall be made in the facility to determine the level of cleanness present.
- G. The tie-in shall be made as quickly as possible. A nitrogen purge is not required since this would require another opening in the pipe.
- H. After the tie-in is made and allowed to cool, slowly bleed the source Vacuum back into the pipeline. Test the work area for leaks with soapy water and repair any leaks.
- I. After all leaks, if any, are repaired and the line is fully recharged, perform blow down and testing. Open the zone that is closest to the main to the system, access the closest outlet to the work, and blow the main through the inlet. After the inlet blows clear into a white cloth, make an additional check at a zone most distant from the work. Perform all required current NFPA tests after connection.

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**SECTION 22 63 00**  
**GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Central Laboratory and Healthcare Gas Systems: Consisting of oxygen, and compressed air services; complete, ready for operation, including all necessary piping, fittings, valves, cabinets, gages, alarms including low voltage wiring, air compressors, electric motors and starters, air dryers, filters, pressure regulators, dew point, carbon monoxide monitors and all necessary parts, accessories, connections and equipment.
- B. Oxygen System: Provide Emergency Oxygen Inlet (EOI) consisting of surface mount valved auxiliary oxygen supply connection, pressure gauges, high-low pressure switches, relief valves, check valves, and alarms including all low voltage wiring.
- C. Laboratory and healthcare gas system alarm wiring from equipment to alarm panels.

**1.2 RELATED WORK**

- A. Sealing around pipe penetrations to maintain the integrity of time rated construction: Section 07 84 00, FIRESTOPPING.
- B. Sealing around pipe penetrations through the floor to prevent moisture migration: Section 07 92 00, JOINT SEALANTS.
- C. General requirements and items common to Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Vacuum Piping and Equipment: SECTION 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES
- E. Electric motors: Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
- F. Control wiring: Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
- G. Conduit: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
- H. Motor starters: Section 26 29 11, MOTOR STARTERS.

### **1.3 QUALITY ASSURANCE**

- A. Materials and Installation: In accordance with NFPA 99, (2005) and as specified.
- 1) All components to follow facility design standards.
- B. Equipment Installer: Show technical qualifications and previous experience in installing laboratory and healthcare equipment on three similar projects. Submit names and addresses of referenced projects. Installers shall meet the qualifications of ANSI/ASSE Standard 6010.
- C. Equipment Supplier: Show evidence of equivalent product installed at three installations similar to this project that has been in satisfactory and efficient operation for three years. Submit names and addresses where the product is installed.
- D. Laboratory and healthcare System Testing Organization: The testing shall be conducted by a party technically competent and experienced in the field of laboratory and healthcare pipeline testing. Testing and systems verification shall be performed by personnel meeting the qualifications of ANSI/ASSE Standard 6030. Such testing shall be performed by a party other than the installing contractor.
- E. Provide names of three projects where testing of medical or laboratory gases systems has been performed by the testing agency. Include the name of the project, names of such persons at that project who supervised the work for the project owner, or who accepted the report for the project owner, and a written statement that the projects listed required work of similar scope to that set forth in this specification.
- F. Submit the testing agency's detailed procedure which will be followed in the testing of this project. Include details of the testing sequence, procedures for cross connection tests, outlet function tests, alarm tests, purity tests, etc., as required by this specification. For purity test procedures, include data on test methods, types of equipment to be used, calibration sources and method references.
- G. Certification: Provide documentation prior to submitting request for final inspection to include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits allowed by this specification.
- H. Installing contractor shall maintain as-built drawings of each completed phases for verification; and, shall provide the complete set at the time

of final systems certification testing, for certification by the Third Party Testing Company. As-built drawings shall be provided on prints and in digital format. The digital format shall be in the native CAD system required for the project design. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

- I. "Hot taps" are not permitted for operating medical oxygen systems. Methods for connection and extension of active and pressurized medical gas systems without subsequent medical gas testing and verification are not allowed.

#### **1.4 SUBMITTALS**

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Manufacturer's Literature and Data:

1. Piping.
2. Valves.
3. Valve cabinets.
4. Gages.
5. Alarm controls and panels.
6. Pressure Switches.
7. Air compressor systems (Provide certified compressor test data at start-up.):
  - a. Compressors: Manufacturer and model.
  - b. Characteristic performance curves.
  - c. Compressor operating speed (RPM).
  - d. Capacity: Free air delivered at indicated pressure (L/s) (SCFM).
  - e. Type of bearing in compressor.
  - f. Type of lubrication.
  - g. Type and adjustment of drive.
  - h. Electric motors: Manufacturer, frame and type.
  - i. Speed of motors (RPM).

- j. Current characteristics and horsepower of motors.
- k. Receiver capacity and rating.
- l. Air silencer: Manufacturer, type and model.
- m. Air filters: Manufacturer, type, model and capacity.
- n. Pressure regulators: Manufacturer and capacity.
- o. Dew point monitor: Manufacturer, type and model.
- p. Air dryers: Manufacturer, type, model and capacity (L/s) (SCFM).
- q. Carbon monoxide monitor manufacturer, type and model.
- r. Aftercoolers.

C. Certification: The completed systems have been installed, tested, purged, analyzed and verified in accordance with the requirements of this specification.

#### **1.5 TRAINING**

- A. 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 laboratory and healthcare gas systems, on the dates requested by COR.
- B. Coordinate with other requirements specified in Section 01 00 00, GENERAL REQUIREMENTS.

#### **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 test by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - B819- (R2006) ..... Seamless Copper Tube for Medical Gas Systems
- C. American Society of Mechanical Engineers (ASME):
  - A13.1-07 ..... Scheme for Identification of Piping Systems
  - B16.22-01 (R2005) ..... Wrought Copper and Bronze Solder-Joint Pressure Fittings
  - B40.100 (2005) ..... Pressure Gauges and Gauge Attachments Boiler and Pressure Vessel Code -
  - Section VIII-07 ..... Pressure Vessels, Division I



Section IX-07..... Welding and Brazing Qualifications

D. American Welding Society (AWS):

AWS A5.8-04..... Brazing Filler Metal

AWS B2.2-91..... Standard for Brazing Procedure and Performance  
Qualification (Modified per NFPA 99)

E. Compressed Gas Association (CGA):

G-4.1 (2009)..... Cleaning Equipment for Oxygen Service

F. National Electrical Manufacturers Association (NEMA):

ICS-6-93(R2006)..... Industrial Controls and Systems Enclosures

G. National Fire Protection Association (NFPA):

99-05..... Health Care Facilities

H. United States Pharmacopoeia XXI/National Formulary XVI (USP/NF)

I. Manufacturing Standardization Society (MSS):

MSS-SP-72-99..... Ball Valves With Flanged or Butt Welding For  
General Purpose

MSS-SP-110-96..... Ball Valve Threaded, Socket Welding, Solder Joint,  
Grooved and Flared Ends

MSS-SP-73-03..... Brazing Joints for Copper and Copper Alloy Solder  
Pressure Fittings

**PART 2 - PRODUCTS**

**2.1 PIPING AND FITTINGS**

- A. Copper Tubing: Type "K", ASTM B819, seamless copper tube, hard drawn temper, with wrought copper fittings conforming to ASME B16.22 or brazing fittings complying with MSS SP-73. Size designated reflecting nominal inside diameter. All tubing and fittings shall be labeled "ACR/OXY", "OXY", "OXY/MED", "ACR/MED", or "MED".
- B. Brazing Alloy: AWS A5.8, Classification BCuP, greater than 537 °C (1000 °F) melting temperature. Flux is strictly prohibited for copper-to-copper connections.
- C. Screw Joints: Polytetrafluoroethylene (teflon) tape.

- D. Memory metal couplings: Temperature and pressure rating shall not be less than that of a brazed joint.
- E. Apply piping identification labels at the time of installation in accordance with current NFPA. Apply supplementary color identification in accordance with CGA Pamphlet C-9.
- F. Special Fittings: The following special fittings shall be permitted to be used in lieu of brazed joints:
  - 1. Memory-metal couplings having temperature and pressure ratings joints not less than that of a brazed joint.
  - 2. Listed or approved metallic gas tube fittings that, when made up, provide a permanent joint having the mechanical, thermal, and sealing integrity of a brazed joint.
  - 3. Dielectric fittings where required by the manufacturer of special medical equipment to electrically isolate the equipment from the piping distribution system.
  - 4. Axially swaged, elastic strain preload fittings providing metal to metal seal having pressure and temperature ratings not less than that of a brazed joint and when complete are permanent and non-separable.

## **2.2 VALVES**

- A. Ball: In-line, other than zone valves in cabinets:
  - 1. Seventy five millimeter (2 1/2 inches) and smaller: Bronze/ brass body, Fed. Spec. MSS SP72 & SP 110 , Type II, Class 150, Style 1, with tubing extensions for brazed connections, full port, three-piece or double union end connections, teflon seat seals, full flow, 4125 kPa ( 600 psi) WOG minimum working pressure, with locking type handle, cleaned for oxygen use and labeled for intended service
  - 2. Eighty to one hundred millimeter (3-4 inches): Bronze/ brass body, Fed. Spec. MSS SP72 & SP 110, Type II, Class 150, Style 1 with tubing extensions brazed to flanges, full port~~ed~~, three piece, double seal, teflon seals, full flow, 4125 kPa (600 psi) WOG minimum working pressure, with locking type handle, cleaned for oxygen use and labeled for intended service.
  - 3. Valves not in valve boxes shall be provided with locking handles, similar to BeaconMedæ's series 4255. Locks to be provided by contractor to owner.

B. Check:

1. Eighty millimeter (3 inches) and smaller: Bronze/brass body, straight through design for minimum pressure drop, spring loaded, self aligning with teflon cone seat, vibration free, silent operation, supplied NPT female threads at each end with flow direction arrow permanently cast into, cleaned for oxygen use and labeled for intended service, 2750 kPa (400 psi) WOG minimum working pressure.

### 2.3 GAGES

A. Pressure Gages: Includes gages temporarily supplied for testing purposes.

1. For line pressure use adjacent to source equipment: ASME B40.1, pressure gage, single, size 115 mm (4-1/2 inches), for compressed air and oxygen, accurate to within two percent, with metal case. Range shall be two times operating pressure. Dial graduations and figures shall be black on a white background, or white on a black background. Gage shall be cleaned for oxygen use, labeled for appropriate service, and marked "USE NO OIL". Install with gage cock.
2. For all services downstream of main shutoff valve: Manufactured for oxygen use, labeled for the appropriate service and marked "USE NO OIL", 40 mm (1-1/2 inch) diameter gage with dial range 1-690 kPa (1-100 psi) for air service, and 1-690 kPa (1-100 psi) for OXYGEN service .

### 2.4 ALARMS

A. Provide all low voltage control wiring, except for wiring from alarm relay interface control cabinet to ECC, required for complete, proper functioning system, in conformance with Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Run wiring in conduit, in conformance with Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

B. Local Alarm Functions: Provide individual local air compressor malfunction alarms at each compressor system main control panel.

1. Compressor Malfunction Alarm: Each compressor system receiving any of the following individual signals and sends a single combined "compressor malfunction alarm" signal to master alarm panel.
  - a. Thermal Malfunction Alarm: Functions when discharge air temperature exceeds 177 °C (350 °F), shutting down affected compressor.

- b. Lead Compressor Fails to Start: Functions when lead compressor fails to start when actuated, causing lag pump to start.
  - c. Lag Compressor in Use: Functions when the primary or lead compressor is incapable of satisfying the demand. When three or more compressors are part of the system, the lag compressor in use alarm shall energize when the last compressor has been signaled to start.
  - d. High Water Level in Receiver. (Liquid ring or water-cooled units)
  - e. High Water Level in Separator (if so required). (Liquid ring unit)
2. Desiccant Air Dryer Malfunction Alarm: Dryer receives the following individual signals and sends a single consolidated dryer malfunction alarm signal to master alarm panel.
- a. Dew Point Alarm: Functions when line pressure dew point rises above 4 °C (39 °F) at 380 kPa (55 psi).
3. Vacuum Pump Malfunction Alarm: Pump system receives the following individual signals and sends a single consolidated pump malfunction alarm signal to master alarm.
- a. High Temperature Shut down Alarm: Functions when exhaust air temperature exceeds 104 °C (220 °F), shutting down affected pump.
  - b. Lead Pump Fails to Start Alarm: Functions when lead pump fails to start when actuated causing lag pump to start.
  - c. Lag Pump In Use Alarm: Functions when the primary or lead vacuum pump is incapable of satisfying the demand. When three or more vacuum pumps are part of the system, the lag pump in use alarm shall energize when the last vacuum pump has been signaled to start.
- C. Master Alarm Functions: Provide the following individual alarms at the master alarm panel.
1. Oxygen Alarms:
- a. Low pressure alarm: Functions when system pressure downstream of the main shutoff valve drops below 275 kPa (40 psi), plus/minus 14 kPa (2 psi); operated by pressure switch or transmitters.
  - b. High pressure alarm: functions when system pressure downstream of main shutoff valve increases above 415 kPa (60 psi), plus/minus 14 kPa (2 psi) set points; operated by pressure switches or transmitters.

2. Compressed Air Alarms:

- a. Medical air dew point high alarm: Functions when the line pressure dew point rises above 2 °C (35 °F) at 380 kPa (55 psi).
- b. Carbon Monoxide Alarm: Functions when the carbon monoxide levels rise above 10 parts per million; receives signal from the carbon monoxide monitor.
- c. Aftercooler High temperature Alarm: Functions when aftercooler discharge air temperature exceeds 38 °C (100 °F).
- d. Pressure Abnormal Alarm: Functions when system pressure downstream of main shutoff valve drops below 550 kPa (80 psi) (plus/minus gage or increases above 830 kPa (120 psi) (plus/minus 14 kPa (2 psi) set points; operated by pressure switch.
- e. Compressor Malfunction Alarm: Functions when compressor system control panel signals compressor thermal malfunction alarm, lead compressor fails to start alarm or high water level in receiver or separator (if so required) receives signal from system control panel.

D. Alarm Functions:

1. Oxygen and compressed air alarms: Pressure alarms: Functions when pressure in branch drops below 275 kPa (40 psi), plus/minus 14 kPa (2 psi) or increases above 414 kPa (60 psi), plus/minus 14 kPa (2 psi) set points; operated by pressure switches or transmitters.
2. Vacuum alarms: Low vacuum alarm: Functions when vacuum in branch drops below 40 kPa (12-inches Hg); operated by vacuum switch.

**2.5 PRESSURE SWITCHES**

General purpose, contact or mercury type, allowing both high and low pressure set points, with contact type provided with a protective dust cover; adjustable range set by inside or outside adjustment; switches activate when indicated by alarm requirements. Use one orifice nipple (or DISS demand check valve) for each sensor or pressure switch.

**2.6 AIR COMPRESSOR SYSTEMS**

- A. System Design: The laboratory air system shall be of a modular base mounted design consisting of duplex compressor, dryer/control, and an air receiver. Each unit must be fully compliant with the latest edition of NFPA 99.

- B. Compressors: Continuous duty rated "oil-less" type with permanently lubricated, sealed bearings. The compressors shall be a continuous duty rated scroll type. The design shall be single stage, air-cooled, consisting of one fixed and one orbiting scroll sealed with PTFE tip seals between the scroll halves and rated for 828 kPa (120 PSIG) discharge pressure. Orbiting bearings shall be grease filled. Compressors shall be field serviceable for tip seal change and bearing lubrication. Non-field serviceable scroll compressors are not acceptable. Noise level shall not exceed 75 dB(A) for duplex system, 78 dB(A) for triplex system, and 80 dB(A) for quad system with pumps running at peak demand. Belt tensioning shall be achieved with a sliding motor mounting base adjustable with two tensioning screws. Each compressor unit shall be equipped with a distinct after cooler with separate cooling fan designed for a maximum approach temperature of 7°C (15°F) at 37.8°C (100°F) ambient and complete with electronic drain valve. Designs using compressor cooling air for the aftercooler are not acceptable. The discharge of piping of each compressor shall incorporate an electronic solenoid valve to prevent reverse rotation of the scroll at shutdown.
- C. Compressor Drive and Motor: V-belt driven through a combination flywheel/sheave and steel motor sheave with tapered bushing and protected by an OSHA approved, totally enclosed belt guard. Belt tensioning shall be achieved by a pivoting motor mounting base that is fully adjustable through twin adjusting screws. The motor shall be a NEMA rated, open drip proof, 1800 RPM, with 1.15 service factor suitable for 208/230/460V electrical service, as specified in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT and Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.
- D. Intake Piping: Provide a pre-piped intake manifold with one "hospital type" inlet air filter with threaded opening for remote intake connection. Isolate filter housing from the intake manifold with a braided 304 stainless steel flex connector.
- E. Discharge Piping: Provide an integral air cooled aftercooler designed for a maximum approach temperature of 12 degrees F complete with moisture separator and timed automatic solenoid drain valve with a manual drain valve by-pass. Provide each cylinder head with a pre-wired high discharge

- air temperature shutdown switch. Include a flex connector, safety relief valve, and check valve. The compressor discharge line the piping shall be of ASTM B-819 copper tubing, brass, and/or stainless steel. The discharge flex connector shall be braided 304 stainless steel, brass or bronze.
- F. Isolation System: Isolate the compressor and monitor from the main compressor module base by means of a four point, heavy duty, spring isolation system for a minimum of 95% isolation efficiency.
- G. Dryer/Control: The dryer/control shall include a NEMA 12, U.L. labeled control system, duplexed desiccant drying system, duplexed final line filters, duplexed final line regulators, and combination dew point/CO monitor. All of the above shall be pre-wired and pre-piped in accordance with NFPA 99 and include valving to allow complete air receiver by-pass, as well as air sampling port.
- H. Dryer: Size each desiccant dryer for the peak calculated demand and capable of producing 10 °F (-12 °C) pressure dew point. Dryer purge flow shall be minimized through an on-demand purge saving control system. Include a mounted prefilter rated for 0.01 micron with automatic drain and element change indicator on the inlet of each dryer.
- I. Control System: Mounted and pre-wired control system shall be NEMA 12 and U.L. labeled. This control system shall provide automatic lead/lag sequencing with circuit breaker disconnects for each compressor with external operators, one non-fused main disconnect with external operators, full voltage motor magnetic starters with overload protection, redundant 120V control circuit transformers, visual and audible reserve unit alarm with isolated contacts for remote alarm, hand-off-auto (HOA) lighted selector switches, automatic alternation of both compressors with provisions for simultaneous operation if required, automatic activation of reserve unit if required, visual alarm indication for high discharge air temperature shutdown with isolated contacts for remote alarm, and duplexed run time hour meters.
- J. Final Line Filters and Regulators: Fully duplexed final line filters rated for 0.01 micron with element change indicators shall be factory mounted and pre-piped, along with duplexed factory mounted and pre-piped final line regulators and duplex safety relief valves.
- K. Dew Point Hygrometer/CO Monitor: Mounted, pre-piped and wired, combination dew point hygrometer/CO monitor shall be of the ceramic type with integral chemical type CO sensor. System accuracy shall be  $\pm 2$  °F for dew point and 2PPM (at 10 PPM) for carbon monoxide. Dew point alarm shall be factory set

at 39 °F (4 °C) per NFPA 99, and the CO alarm shall be factory set at 10 PPM. Both set points shall be field adjustable.

L. Air Receiver: Vertical air receiver, galvanized, ASME Coded, National Board Certified, rated for minimum 150 PSIG design pressure and includes a sight gauge glass as well as a timed automatic solenoid drain valve. Provide three valve bypass on supplyM. Example of an acceptable product and manufacturer: Beacon Medical Products "Lifeline Medical Air Systems".

M. Manufacturer: Beacon Medaes, or equal.

## **2.7 PRESSURE REGULATORS:**

A. For 690 kPa (100 psi) regulator, provide duplex in parallel, valve for maintenance shut-down without service interruption. For additional pressures, locate regulators remote from compressor near point of use, and provide with isolation valves and valve bypass.

1. For systems 5 L/s (10 scfm) and below: Brass or bronze body and trim, reduced pressure range 170 - 850 kPa (25 - 125 psi) adjustable, spring type, diaphragm operated diaphragm operated, relieving. Delivered pressure shall vary not more than one kPa (0.15psi) for each 10 kPa (1.5psi) variation in inlet pressure.

## **2.8 EMERGENCY LOW PRESSURE OXYGEN INLET**

A. The Low Pressure Emergency Oxygen Inlet provides an inlet for connecting a temporary auxiliary source of oxygen to the oxygen pipeline system for emergency or maintenance situations per NFPA 99.

B. The inlet consist of a 1" (25 mm) ball valve, pressure gauge and a 1/2"/1" NPTF connection housed in a weather tight enclosure. The enclosure is labeled "Emergency Low Pressure Gaseous Oxygen Inlet", and includes a padlock staple to prevent tampering or unauthorized access. The enclosure is suitable for recess mounting on the exterior of the building being served. The enclosure is 14 gauge, cold rolled steel with a primer coat of paint. The Emergency Oxygen Inlet is connected at a point downstream of the main supply line shutoff valve.

C. Check valves are provided for installation in the emergency supply line and in the main supply line between the main line shutoff valve and the emergency supply line connection per by NFPA 99. Check valves have a cast bronze body and straight through design for minimum pressure drop.

D. The check valves for sizes under 3" (76 mm) are soft seated, bubble tight, self aligning, and spring loaded, and ball type check valves. Three inch



(76 mm) check valves are hard seated, spring loaded, self aligning ball type checks with cone seats (3" valves may not be "bubble tight"). Check valves are fast acting.

- E. A relief valve is provided for installation in the emergency supply line per NFPA 99. The relief valve has a brass body, single seat design, and is cleaned for oxygen use. It automatically reseats to provide a "bubble tight" seal after discharging excess gas. Pre-set at 75 psi.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- B. Keep open ends of tube capped or plugged at all times or otherwise sealed until final assembly.
- C. Cut piping square and accurately with a tube cutter (sawing not permitted) to measurements determined at place of installation. Ream tube to remove burrs, being careful not to expand tube, and so no chips of copper remain in the tube. Work into place without springing or forcing. Bottom tube in socket so there are no gaps between tube and fitting. Exercise care in handling equipment and tools used in cutting or reaming of tube to prevent oil or grease being introduced into tubing. Where contamination has occurred, material is no longer suitable for oxygen service.
- D. Piping shall be supported with pipe trays or hangers at intervals as shown on the drawings or as defined in NFPA 99 Table 5.1.10.10.4.5. Piping shall not be supported by other piping. Isolation of copper piping from dissimilar metals shall be of a firm, positive nature. Duct tape is not acceptable as an isolation material.
- E. Rigidly support valves and other equipment to prevent strain on tube or joints.
- F. While being brazed, joints shall be continuously purged with *oil* free nitrogen. The flow of purged gas shall be maintained until joint is cool to touch.
- G. Do not bend tubing. Use fittings.
- H. Install pressure switches, transmitter and gauges to be easily accessed. Install pressure switch and sensors with orifice nipple between the pipe line and switches/sensors.

- I. Apply pipe labeling during installation process and not after installation is completed. Size of legend letters shall be in accordance with ANSI A13.1.
- J. Pipe compressor intake to a source of clean ambient air as indicated in current NFPA.
- K. After initial leakage testing is completed, allow piping to remain pressurized with testing gas until testing agency performs final tests.
- L. Penetrations:
  - 1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoked 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 intumescent materials only. Completely fill and seal clearances between raceways and openings with the fire stopping material.
  - 2. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- M. Piping shall be labeled with name of service, identification color and direction of flow. Where non-standard pressures are piped, pressure shall be labeled. Labels shall be placed at least once every 20 feet of linear run or once in each story (whichever is more frequent). A label shall additionally be placed immediately on each side of all wall or floor penetrations. Pipe labels shall be self adhesive vinyl type or other water resistant material with permanent adhesive colored in accordance with NFPA 99 Table 5.1.11 and shall be visible on all sides of the pipe. Each master alarm signal shall be labeled for function after ring out. Labels shall be permanent and of a type approved by the VAMC

### **3.2 TESTS**

- A. Initial Tests: Blow down, and high and low pressure leakage tests as required by current NFPA with documentation.
- B. Laboratory and healthcare testing agency shall perform the following:
  - 1. Perform and document all cross connection tests, labeling verification, supply system operation, and valve and alarm operation tests as required by, and in accordance with, current NFPA and the procedures set forth in pre-qualification documentation.

2. Verify that the systems, as installed, meet or exceed the requirements of current NFPA, this specification, and that the systems operate as required.
3. Piping purge test: For each positive pressure gas system, verify cleanliness of piping system. Filter a minimum of 35 cubic feet (1000 liters) of gas through a clean white 0.45 micron filter at a minimum velocity of 3.5 scfm (100 Lpm). Filter shall show no discoloration, and shall accrue no more than 0.1 mg of matter. Test each zone at the outlet most remote from the source. Perform test with the use of an inert gas as described in CGA P-9.
4. Piping purity test: For each positive pressure system, verify purity of piping system. Test each zone at the most remote outlet for dew point, carbon monoxide, total hydrocarbons (as methane), and halogenated hydrocarbons, and compare with source gas. The two tests must in no case exceed variation as specified in Paragraph, Maximum Allowable Variation. Perform test with the use of an inert gas as described in CGA P-9.
5. Source Contamination Test: Analyze each pressure gas source for concentration of contaminants, by volume. Take samples for air system test at the intake and at a point immediately downstream of the final filter outlet. The compared tests must in no case exceed variation as specified in Paragraph, Maximum Allowable Variation. Allowable concentrations are below the following:

Dew point, air	4 degrees C (39 degrees F) pressure dew point at 690 kPa (100 psi)
Carbon monoxide, air	10 mg/L (ppm)
Carbon dioxide, air	500 mg/L (ppm)
Gaseous hydrocarbons as methane, air	25 mg/L (ppm)
Halogenated hydrocarbons, air	2 mg/L (ppm)

6. Analysis Test:
  - a. Analyze each pressure gas source and outlet for concentration of gas, by volume.

- b. Make analysis with instruments designed to measure the specific gas dispensed.
- c. Allowable concentrations are within the following:

Oxygen	>=97 plus percent oxygen
Medical air	19.5 percent to 23.5 percent oxygen

7. Maximum Allowable Variation: Between comparative test results required are as follows:

Dew point	2 degrees C (36 degrees F)
Carbon monoxide	2 mg/L (ppm)
Total hydrocarbons as methane	1 mg/L (ppm)
Halogenated hydrocarbons	2 mg/L (ppm)

### 3.3 CONNECTION TO EXISTING HEALTHCARE GAS SYSTEM:

- A. Contactor shall test the existing system for hydrocarbons, dew point, etc. If problems are present, the COR would notify the facility of the results. The facility would then make the necessary repairs and/ or maintenance.
- B. Install shut-off valve at the connection of new line to existing line.
- C. Coordinate time for shut-down of the existing healthcare system with the VA medical center.
- D. Shut off all oxygen zone valves and gas riser valves if the section to be connected to cannot be totally isolated from the remainder of the system.
- E. Prior to any work being done, check the new pipeline for particulate or other forms of contamination.
- F. Insure that the correct type of pipe tubing and fittings are being used.

- G. Make a spot check of the existing pipelines in the facility to determine the level of cleanness present.
- H. Reduce the pressure to zero and make the tie-in as quickly as possible. A nitrogen purge is not required since this would require another opening in the pipe.
- I. After the tie-in is made and allowed to cool, slowly bleed the source gas back into the pipeline. Test the work area for leaks with soapy water and repair any leaks.
- J. After all leaks, if any, are repaired and the line is fully recharged, perform blow down and testing. Open the zone that is closest to the main to the system, access the closest outlet to the work, and blow the main through the outlet. After the outlet blows clear into a white cloth, make an additional check at a zone most distant from the work. Perform all required current NFPA tests after connection.

### **3.5 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of units.

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**SECTION 26 05 11**  
**REQUIREMENTS FOR ELECTRICAL INSTALLATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Drawings, Bidding Requirements, Contract Forms, Conditions of the Contract and Division 1 General Requirements apply to work of this section.
- B. This section applies to all sections of Division 26.
- C. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on drawings.
- D. 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 SYMBOLS, AND ABBREVIATIONS, AND ACRONYMS**

Refer to symbols and abbreviations listed on the drawings. Other symbols are in common usage but if uncertainty exists regarding any plan symbols or abbreviations they shall be brought to the attention of the Contracting Officer and he shall clarify same.

**1.3 DEFINITIONS**

- A. Where the phrase starts "Provide \_\_\_\_\_", "provide" shall be construed to mean the same as "Furnish and install \_\_\_\_\_".

**1.4 MINIMUM REQUIREMENTS**

- A. References to the International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.
- B. This Contractor shall comply with all ordinances, laws, regulations and codes applicable to the work involved. This does not relieve the contractor from furnishing and installing work shown or specified which may be beyond the requirements of such ordinances, laws, regulations and codes.
- C. Regular inspections shall be requested by the Contractor as required by any and all regulations. All charges for the inspections by regulating

agencies of installations or plans and specifications shall be paid by the Contractor.

- D. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

#### **1.5 MATERIALS AND WORKMANSHIP**

- A. All material and workmanship must be of the best throughout. All material and equipment must be new and must be adequately protected from damage and dirt at all times. The Contracting Officer reserves the right to reject any material or workmanship not in accordance with the specifications, either before or after installation.
- B. The Contractor will be held responsible for any and all defects in material and workmanship which may appear during guarantee period after the building has been accepted. All such defects must be repaired or defective material replaced by the Contractor at no expense to the Government.

#### **1.6 ADMINISTRATIVE REQUIREMENTS**

- A. Site Mobilization Meeting: Attend meeting at the Project site prior to Contractor occupancy.
- B. Preconstruction Meeting: Attend preconstruction meeting prior to the start of the work of this section.

#### **1.7 INSPECTION OF SITE**

- A. Before submitting a proposal on the work contemplated in this specification and accompanying drawings, each bidder shall examine the site and check as to the means of making connections to services and shall familiarize himself with all the existing conditions and limitations.
- B. No extras will be allowed because of the contractor's misunderstanding as to the amount of work involved or the contractor's lack of knowledge of any site conditions which may affect their work.
- C. Any apparent variance of the plan or specification from the existing conditions at the site shall be called to the attention of the Contracting Officer.

#### **1.8 DRAWINGS**

- A. The drawings are to scale as noted. The Contractor shall refer to architectural and structural drawings for exact location of partitions, walls, beams, shafts, equipment, etc.

- B. The Contractor, before rough-in facilities or installation of any equipment shall consult all drawings, general, structural, mechanical, finishes, locations of ceiling, structural members, pipes, ducts, recessed lighting fixtures, conduits, etc., which may affect the installation.
- C. Discrepancies discovered before or after work has started shall be brought to the attention of Government: Contracting Officer. Government reserves the right to require minor changes in the work of any Contractor to eliminate such discrepancies with no change in contract cost.
- D. The plans and specifications are complementary and what is called for in either one shall be as binding as if called for in both.
- E. Where a disagreement exists between the plans and specifications, the item or arrangement of better quality, greater quantity or higher cost shall be used.
- F. Where a disagreement exists between an item on the drawings and another item on the drawings, the item or arrangement of better quality, greater quantity or higher cost shall be used.

#### **1.9 COORDINATION**

- A. This Contractor shall review drawings and specifications from all divisions for conflicts in work for locations of ducts, piping, sprinkler heads, door hardware schedule for devices, ceiling plans, wall elevations, etc. Discrepancies shall be brought to the attention of the Contracting Officer prior to beginning the work.
- B. Coordinate with all sub-contractors for locations of all conduit, supports, and new and existing equipment.
- C. Attend Preinstallation and Coordination meetings, if required by individual Section.

#### **1.10 GUARANTEE**

- A. All electrical work specified in Division 26 sections shall be guaranteed to be free from defects in materials and installation for a minimum period of one year from the Date of Acceptance of the Work. See Division 1 requirements and General Conditions for additional requirements. The Contractor shall repair and/or replace defective work, including materials and labor, discovered during the guarantee period.
- B. See individual specification sections for additional guarantees, which include guarantees that extend beyond one year.

#### **1.11 TEMPORARY CONSTRUCTION LIGHTING AND POWER**

- A. Temporary Electricity:



1. Cost: By Government.
2. Connect to Owner's existing non-emergency power service.
  - a. Do not disrupt Owner's need for continuous service.
  - b. Coordinate and schedule all necessary shutdowns with Government.  
Schedule all necessary shutdowns 14 days in advance.
  - c. Include actual time and duration of necessary shutdown in scheduled shutdown request.
  - d. Exercise measures to conserve energy.
4. Complement existing power service capacity and characteristics as required.
5. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.
7. Existing non-emergency-powered convenience receptacles may be utilized during construction.

#### **1.12 HOLES THROUGH MASONRY**

- A. The Contractor shall provide all holes and openings required for electrical work unless such openings are shown on the architectural and/or structural drawings. The notes on structural drawings are particularly significant when precast and prestressed members are used.
- B. Holes made in existing masonry for raceways or other electrical equipment shall be core drilled.
- C. The Contractor shall be responsible for grouting air-tight any openings adjacent to raceways, etc. to seal against passage of air, smoke or vapors.
- D. The Contractor shall be responsible for providing and disposing of water used in the core drilling operation. Work shall be scheduled and other trades coordinated so that damage will not result from the use of water.

#### **1.13 FIRESTOPPING**

Refer to Section 07 84 00 Firestopping for requirements.

#### **1.14 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, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled; Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified; equipment or product 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.

**1.15 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.

**1.16 APPLICABLE PUBLICATIONS**

Applicable publications listed in all Sections of Division are the latest issue, unless otherwise noted.

**1.17 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 or type 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.

### **1.18 EQUIPMENT REQUIREMENTS**

Where variations from the contract requirements are requested in accordance with 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.

### **1.19 EQUIPMENT PROTECTION**

- A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
  - 1. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to motor controllers, enclosures, controllers, circuit protective devices, cables, wire, electronic equipment, and accessories.
  - 2. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
  - 3. Damaged equipment shall be, as determined by the COR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
  - 4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  - 5. 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.

### **1.20 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. Lockout/Tagout: Procedures shall match existing Veterans Administration Standards. Refer to Section 01 00 00 GENERAL REQUIREMENTS; Lockout/Tagout. Submit lockout/tagout procedures to Government.

- D. 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 COR 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 COR.
- E. For work on existing stations, arrange, phase and perform work to assure electrical service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- F. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- G. Coordinate location of equipment and conduit with other trades to minimize interferences.

#### **1.21 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" and "Readily Accessible" are defined as being capable of being reached quickly for operation, maintenance, or inspections 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.

#### **1.22 EQUIPMENT IDENTIFICATION**

- A. Refer to Section 26 05 53 - Identification for Electrical Systems.

#### **1.23 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. .
- B. Where an individual Section requires more than one identified item for review (i.e. "Shop Drawings", "Product Data", "Calculations", "Warranty", and "Samples"), submit all items concurrently.
- C. Provide tabbed divider separating each item for review included in the submittal (i.e. "Product Data", "Shop Drawings", and "Warranty").
- D. 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.
- E. 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. Mark catalog sheets and drawings to indicate specific items submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. .
  1. Failure to properly identify items included in a submittal may result in the submittal(s) returned to the Contractor for correction and resubmission.
- F. 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.

G. 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. Parts list which shall include those replacement parts recommended by the equipment manufacturer.

F. Failure to follow submittal instructions does not relieve the Contractor from the requirements of meeting the project schedule.

G. 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. .
  - a. Table of contents shall identify each tabbed divider by Section number and Section name.
4. The manuals shall include:
  - a. Maintenance Schedule: Provide a consolidated maintenance schedule. Indicate item or equipment, maintenance or testing requirement and frequency of maintenance or test. Provide in a table format.
  - b. Sample Consolidated Maintenance Schedule: Table below is a sample representing some typical maintenance items, not representative of actual items included in this project.

<b>CONSOLIDATED MAINTENANCE SCHEDULE</b>		
<b>EQUIP ITEM</b>	<b>REQUIRED ACTION</b>	<b>FREQUENCY</b>
GROUNDING CONNECTIONS	INSPECT FOR INTEGRITY	12 MONTHS
PANELBOARD CIRCUIT BREAKERS	EXERCISE: CYCLE OFF/ON 5 TIMES.	12 MONTHS
SWITCHBOARD & PANELBOARD FUSIBLE SWITCHES	INSPECT, CLEAN, LUBRICATE	12 MONTHS
ENCLOSED SWITCHES	INSPECT, CLEAN, LUBRICATE	12 MONTHS
LUMINAIRES IN HANGAR	CLEAN LENS WITH MILD DETERGENT, RINSE, DRY.	24 MONTHS
LENSED LUMINAIRES	CLEAN LENS WITH MILD DETERGENT, RINSE, DRY.	36 MONTHS
EMERGENCY LIGHT UNIT EQUIPMENT	OPERATION AND BATTERY TEST.	12 MONTHS
FIRE ALARM COMPONENTS	INSPECT AND TEST PER NFPA 72 TABLES 14.3.1, 14.4.2.2, AND 14.4.5 ON FOLLOWING PAGES.	PER NFPA 72

- c. Approved product data and shop drawings.
- d. Include test reports.
- e. Include inspector's reports.
- f. Include warranty information.
- g. Include Certificates on Completion.
- i. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
- j. Description of the function of each principal item of equipment.
- k. Safety precautions for operation and maintenance.
- l. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers and replacement frequencies.
- m. 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.
- n. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

#### H. RECORD DRAWINGS



1. The Contractor shall keep a complete set of all drawings in his job site office for the purposes of showing "As-Built" installation of electrical systems and equipment. This set of drawings shall be used for no other purpose.
  2. Where any material, equipment, or system components are installed differently from that shown on the Contracting Officer's drawings, such differences shall be clearly and neatly shown on this set of drawings using ink or indelible pencil.
  3. The change notations shall be kept up-to-date on a daily basis. When requested, this set of drawings shall be transmitted to the Contracting Officer, and after the Contracting Officer has examined the drawings, the set will be returned to the contractor for further use.
  4. At the completion of the project, the "As-Built" set of drawings shall be turned over to the COR for review and then shall become the property of the Government.
- I. Approvals will be based on complete submission of manuals together with shop drawings.
- J. After approval and prior to installation, furnish the COR 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.

#### **1.24 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.

#### **1.25 ACCEPTANCE CHECKS AND TESTS**

The contractor shall furnish the instruments, materials and labor for field tests.

#### **1.26 TRAINING**

- A. Training shall be provided in accordance with Article 1.25, 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 COR at least 30 days prior to the planned training.

**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION - NOT USED**

- - - E N D - - -

**SECTION 26 05 12**  
**ELECTRICAL DEMOLITION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

Electrical demolition.

**1.2 RELATED REQUIREMENTS**

A. Section 02 41 00 - DEMOLITION.

**PART 2 - PRODUCTS**

**2.1 MATERIALS AND EQUIPMENT**

Materials and equipment for patching and extending work: As specified in individual sections.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Demolition drawings are based on casual field observation and existing record documents.
- C. Report discrepancies to COR before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

**3.2 PREPARATION**

- A. Coordinate utility service outages with COR.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- C. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
  - 1. Obtain permission from Government at least 14 days before partially or completely disabling system.
    - a. Contractor must submit a written request to the COR for permission of any downtime. Contractor can only proceed with the downtime after receipt of written approval from the COR.
  - 2. Make temporary connections to maintain service in areas adjacent to work area.

**3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Remove abandoned wiring to source of supply.
- C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- D. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed. Repair adjacent construction and finishes damaged during demolition and extension work.

1. At construction receiving new finishes, patch and prepare to receive new finishes.
  2. At existing construction not receiving new finishes, patch and provide new finishes to match existing surrounding area.
- E. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- F. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- G. Removal: Remove demolished material from the Project site.
- H. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.
- I. Salvaged equipment: Remove and store. Turn over to owner at end of project.
- J. Dispose of Fluorescent lamps, H.I.D. lamps, and ballasts containing PCBs in accordance with the applicable laws pertaining to the disposal of hazardous waste.

#### **3.4 CLEANING AND REPAIR**

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

- - - END - - -

**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. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- 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.
- D. Section 26 05 33, RACEWAY PATHWAYS, AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 FACTORY TESTS**

Low voltage cables shall be thoroughly tested at the factory per NEMA WC-70 to ensure that there are no electrical defects. Factory tests shall be certified.

**1.5 SUBMITTALS**

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- 1. Manufacturer's Literature and Data: Showing each cable type and rating.
- 2. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the COR:
  - a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
  - b. Certification by the contractor that the materials have been properly installed, connected, and tested.

## **1.6 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 designation only.
- B. American Society of Testing Material (ASTM):
- D2301-04..... Standard Specification for Vinyl Chloride Plastic  
Pressure-Sensitive Electrical Insulating Tape
- C. National Fire Protection Association (NFPA):
- 70-11..... National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA):
- WC 70-09..... Power Cables Rated 2000 Volts or Less for the  
Distribution of Electrical Energy
- E. Underwriters Laboratories, Inc. (UL):
- 44-05..... Thermoset-Insulated Wires and Cables
- 83-08..... Thermoplastic-Insulated Wires and Cables
- 467-071..... Electrical Grounding and Bonding Equipment
- 486A-486B-03..... Wire Connectors
- 486C-04..... Splicing Wire Connectors
- 486D-05..... Sealed Wire Connector Systems
- 486E-94..... Equipment Wiring Terminals for Use with Aluminum  
and/or Copper Conductors
- 493-07..... Thermoplastic-Insulated Underground Feeder and  
Branch Circuit Cable
- 514B-04..... Conduit, Tubing, and Cable Fittings
- 1479-03..... Fire Tests of Through-Penetration Fire Stops

## **PART 2 - PRODUCTS**

### **2.1 CONDUCTORS AND CABLES**

- A. Conductors and cables shall be in accordance with NEMA WC-70 and as specified herein.
- 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. XHHW-2 or THHN-THWN shall be in accordance with NEMA WC-70, UL 44, and UL 83.

D. Color Code:

1. Secondary service feeder and branch circuit conductors shall be color-coded as follows (Contractor to verify):

208/120 volt	Phase	480/277 volt
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored tracer for dedicated neutral, color of tracer to match color of phase conductor.		

2. Use solid color insulation or solid color coating for No. 12 AWG and No. 10 AWG branch circuit phase, neutral, and ground conductors.
3. Conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
  - a. Solid color insulation or solid color coating.
  - b. Stripes, bands, or hash marks of color specified above.
  - c. Color as specified using 0.75 in [19 mm] wide tape. Apply tape in half-overlapping turns for a minimum of 3 in [75 mm] for terminal points, and in junction boxes, pull-boxes, troughs, and manholes. 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.

## 2.2 SPLICES AND JOINTS

- A. In accordance with UL 486A, C, D, E, and NEC.

B. Aboveground Circuits (No. 10 AWG and smaller):

1. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F [105° C], with integral insulation, approved for copper and aluminum 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 manufacturer's packaging, shall be strictly followed.

C. Aboveground Circuits (No. 8 AWG and larger):

1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
2. Field-installed compression connectors for cable sizes 250 kcmil and larger shall have not fewer 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. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

D. Underground Branch Circuits and Feeders:

1. Submersible connectors in accordance with UL 486D, rated 600 V, 190° F [90° C], with integral insulation.

## **2.3 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified for power and lighting wiring, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

## **2.4 WIRE LUBRICATING COMPOUND**

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.



### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. Install in accordance with the NEC, and as specified.
- B. Install all wiring in raceway systems.
- C. Splice cables and wires only in outlet boxes, junction boxes, or pull-boxes.
- D. Wires of different systems (e.g., 120 V, 277 V) 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 panel boards, 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. Use lubricants approved for the cable.
  - 2. Use nonmetallic ropes 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 COR.
  - 4. All cables in a single conduit shall be pulled simultaneously.
  - 5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- I. No more than three single-phase branch circuits shall be installed in any one conduit.

#### **3.2 SPLICE INSTALLATION**

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque values.

- C. 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 FEEDER IDENTIFICATION**

In each interior pull-box and junction box, install metal tags on all circuit cables and wires to clearly designate their circuit identification and voltage

### **3.4 EXISTING WIRING**

Unless specifically indicated on the plans, existing wiring shall not be reused for a new installation.

### **3.5 ACCEPTANCE CHECKS AND TESTS**

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices, such as fixtures, motors, or appliances. Test each conductor with respect to adjacent conductors and to ground.
- B. Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.
- B. Perform phase rotation test on all three-phase circuits.
- C. The contractor shall furnish the instruments, materials, and labor for all 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 the general grounding and bonding requirements for electrical equipment and operations 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 made, supplementary, and lightning protection system 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.
- C. Section 26 24 16, CIRCUIT BREAKERS AND PANELBOARDS: Low voltage panelboards.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Conform to requirements of NFPA 70.

**1.4 PERFORMANCE REQUIREMENTS**

Grounding System Resistance: 5 ohms.

**1.5 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - A. Product Data:
    - 1. Provide for grounding mechanical connectors.
  - B. Shop Drawings:

1. Clearly present enough information to determine compliance with drawings and specifications.
- C. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COR:
1. Certification that the materials and installation are in accordance with the drawings and specifications.
  2. Certification by the contractor that the complete installation has been properly installed and tested.
- D. Operation and Maintenance Manual:
1. Include Test Reports.

#### **1.6 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 designation only.

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

- B1-07..... Standard Specification for Hard-Drawn Copper Wire
- B3-07..... Standard Specification for Soft or Annealed Copper Wire
- B8-04..... 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
- C2-07..... National Electrical Safety Code

C. National Fire Protection Association (NFPA):

- 70-08..... National Electrical Code (NEC)
- 99-2005..... Health Care Facilities

D. Underwriters Laboratories, Inc. (UL):

- 44-05 ..... Thermoset-Insulated Wires and Cables
- 83-08 ..... Thermoplastic-Insulated Wires and Cables

467-07 ..... Grounding and Bonding Equipment

486A-486B-03 ..... Wire Connectors

## **PART 2 - PRODUCTS**

### **2.1 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be UL 44 or UL 83 insulated stranded copper, except that sizes No. 10 AWG [6 mm<sup>2</sup>] and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG [25 mm<sup>2</sup>] and larger shall be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG [6 mm<sup>2</sup>] and smaller shall be ASTM B1 solid bare copper wire.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein
- B. 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.
- C. Special Grounding: For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

### **3.2 INACCESSIBLE GROUNDING CONNECTIONS**

- A. At interior locations: All grounding connections shall be accessible.

### **3.3 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS**

- A. Panelboards:
  - 1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
  - 2. Connect metallic conduits that terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

### **3.5 RACEWAY**

#### **A. Conduit Systems:**

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. 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.

#### **B. Feeders and Branch Circuits:** Install equipment grounding conductors with all feeders and power and lighting branch circuits.

#### **C. 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.

#### **D. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.**

### **3.6 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.

### **3.7 CONDUCTIVE PIPING**

- #### **A.**
- Bond all conductive piping systems, interior and exterior, 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.

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**SECTION 26 05 33**  
**RACEWAY, PATHWAYS, 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. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items 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 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- A. Shop Drawings:
  - 1. Size and location of main feeders.
  - 2. Size and location of pull-boxes.
  - 3. Layout of required conduit penetrations through structural elements.
- B. Certifications:
  - 1. Two weeks prior to the final inspection, submit four copies of the following certifications to the COR:
    - a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.



- b. Certification by the contractor that the material has been properly installed.

C. Project Record Documents: Record actual routing for feeder conduits installed.

#### **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):

C80.1-05..... Electrical Rigid Steel Conduit

C80.3-05..... Steel Electrical Metal Tubing

C80.6-05..... Electrical Intermediate Metal Conduit

C. National Fire Protection Association (NFPA):

70-08..... National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

1-05..... Flexible Metal Conduit

5-04..... Surface Metal Raceway and Fittings

6-07..... Electrical Rigid Metal Conduit - Steel

50-95..... Enclosures for Electrical Equipment

360-093..... Liquid-Tight Flexible Steel Conduit

467-07..... Grounding and Bonding Equipment

514A-04..... Metallic Outlet Boxes

514B-04..... Conduit, Tubing, and Cable Fittings

514C-96..... Nonmetallic Outlet Boxes, Flush-Device Boxes and  
Covers

651-05..... Schedule 40 and 80 Rigid PVC Conduit and Fittings

651A-00..... Type EB and A Rigid PVC Conduit and HDPE Conduit

797-07..... Electrical Metallic Tubing

1242-06..... Electrical Intermediate Metal Conduit - Steel

E. National Electrical Manufacturers Association (NEMA):

- TC-2-03..... Electrical Polyvinyl Chloride (PVC) Tubing and  
Conduit
- TC-3-04..... PVC Fittings for Use with Rigid PVC Conduit and  
Tubing
- FB1-07..... 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 0.75 in [13 mm] unless otherwise shown.

B. Conduit:

1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
2. Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
3. Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
4. Liquid-tight flexible metal conduit: Shall conform to UL 360.

Use of flexible conduit is prohibited. Exceptions are: whips for light fixtures (4' Max) and vibration isolation (3' Max).

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
  - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
  - c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
  - d. 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.

- e. 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.
  - f. 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. Electrical metallic tubing fittings:
- a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Compression couplings and connectors: Concrete-tight and rain-tight, with connectors having insulated throats. Use of compression fittings are prohibited unless required by the environment. Set screw type are preferred.
  - 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.
3. Liquid-tight flexible metal conduit fittings:
- a. Fittings shall meet the requirements of UL 514B and 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.
4. Expansion and deflection couplings:
- a. Conform to UL 467 and UL 514B.
  - b. Accommodate a 0.75 in [19 mm] 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 a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding 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 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] 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. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers. Provide mud rings for all flush mounted boxes.
5. Wall boxes shall be 4"x2-1/8" and ceiling boxes shall be 4-11/16"x2-1/8".

F. Medical Alarm Cabling Supports:

1. TIA-569-B and UL-listed for cabling supports.
2. Galvanized steel, wide base with smooth beveled edges, 2-inch diameter, 3.9 square inch minimum cross-sectional area, capable of supporting up to (25) 0.354-inch diameter cables.
3. Mounting brackets as required including straight, angled, threaded rod/flange, and screw-on beam assembly brackets.

**PART 3 - EXECUTION**

**3.1 PENETRATIONS**

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.
  2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the COR as required by limited working space.
- B. Firestop: 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.
- 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 specified herein.
- B. Essential Electrical Systems raceway systems shall be entirely independent of other raceway systems, except where shown on drawings. Essential Electrical Systems include:
1. Emergency - Life Safety Branch.
  2. Emergency - Critical Branch.
  3. Equipment System.
- C. Install conduit as follows:
1. Complete mechanically and electrically continuous runs before pulling in cables or wires.
  2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
  3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
  4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  5. Cut square, ream, remove burrs, and draw up tight.
  6. Independently support conduit at 8 ft [2.4 M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting

members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.

7. Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
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. Conduit bodies shall only be used for changes in direction, and shall not contain splices.

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. There shall be no more than 360 degrees in total turns between boxes.

E. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown on drawings.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COR.
3. All J-Boxes shall be labeled with the panel numbers and circuit numbers. See Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

### **3.3 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical rooms, electrical rooms, crawl spaces, and utility tunnels.
- B. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.
- C. Align and run conduit parallel or perpendicular to the building lines.

- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- F. Surface metal raceways: Prohibited.

### **3.4 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. Provide PVC coated galvanized rigid steel similar to Robroy within 5 ft [1.5 M] of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Use of PVC tape is strictly prohibited.

### **3.5 MOTORS AND VIBRATING EQUIPMENT**

- A. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.

### **3.6 EXPANSION JOINTS**

- A. Provide conduits smaller than 3 in [75 mm] with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 in [125 mm] vertical drop midway between the ends. Flexible conduit shall have a bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for conduits 15 in [375 mm] and larger are acceptable.
- B. Install expansion and deflection couplings where shown.

### **3.7 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- 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 200 lbs [90 kg].  
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 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.

b. Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].

c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts.

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.

### **3.8 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 mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] 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 labels. See Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

### **3.9 MEDICAL ALARM CABLING SUPPORT INSTALLATION**

- A. Medical alarm cables will be furnished and installed by the Government using cable pathways furnished and installed by the Mechanical Contractor.
- B. Obtain final medical alarm cabling routing and cable quantity information from COR.
- C. Field-verify cable support routing pathway prior to ordering cabling supports and accessories.
- D. Install cabling supports at a maximum of 5-feet on-center for entire medical alarm cabling pathway through building and between buildings as required.
- E. Record cabling support locations and alarm cabling routing on mechanical record drawings at project closeout and review with COR.

- - - E N D - - -

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Floor marking tape and floor clearance markers.

**1.2 RELATED REQUIREMENTS**

- A. Section 09 91 00 - PAINTING.
- B. Section 26 05 21 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

**1.3 REFERENCE STANDARDS**

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, including all applicable amendments and supplements.
- B. NFPA 70E - Standard for Electrical Safety in the Workplace; 2009.

**1.4 SUBMITTALS**

- A. See Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit all product data and samples concurrently.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for:
  - 1. Cable and Wire Markers.
  - 2. Voltage Markers, indicate size and text height.
  - 3. Floor Markings.
- D. Samples:
  - 1. Identification Nameplates: One of each type and color specified.
  - 2. Identification Labels: One of each type and color specified.
  - 3. Cable and Wire Markers.

## **PART 2 - PRODUCTS**

### **2.1 IDENTIFICATION REQUIREMENTS**

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Panelboards:

1) Equipment identification nameplate:

(a) Include equipment identification name.

(b) Include voltage and phase.

(c) Include ampere interrupting capacity (AIC) or short circuit current rating (SCCR).

(d) Include power source, circuit number and location.

2) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.

3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.

4) For power distribution panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

5) For disconnecting means, use identification nameplate to indicate description and power source; i.e.

STEAM PRESS AGITATOR 402-7-6A9  
SOURCE MCC-7A6

6) Use identification label inside door of fusible switch assemblies to identify fuse class installed.

2. Emergency System Equipment:

a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.

b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.

c. All emergency system labels shall be red Phenolic plates with white lettering.

C. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 21.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:

a. At each source and load connection.

b. Within boxes.

D. Identification for Conduit:

1. Definitions:

a. Accessible spaces: Spaces above accessible ceiling tile, spaces with access panels, accessible void spaces, accessible attic spaces.

b. Finished spaces: Normally occupied spaces that are not defined as unfinished spaces.

c. Unfinished spaces: Mechanical rooms, shop spaces, bulk storage, shell space for future construction.

d. Concealed: Not visible from within a finished space.

e. Exposed: Surface installed, visible.

2. Use voltage markers to identify highest voltage present for accessible conduits over 70 volts at maximum intervals of 10 feet.

a. Colors:

1) Normal Power Systems:

- (a) 277/480 Volt System: Orange, with black text "277/480 VOLTS" on marker.
- (b) 120/208 Volt System: Orange, with black text "120/208 VOLTS" on marker.
- 2) Emergency Power Systems: Red with white letters, including voltage, i.e. "EMERGENCY 120/208 VOLTS".
  - (a) Life Safety Branch: Red with white letters, including voltage, i.e. "LIFE SAFETY 120/208 VOLTS".
  - (b) Critical Branch: Red with white letters, including voltage, i.e. "CRITICAL 208/120 VOLTS".
  - (c) Equipment System: Red with white letters, including voltage, i.e. "EQUIPMENT 120/208 VOLTS".
- 3. Use color-coded bands to identify specified systems for accessible conduits at maximum intervals of 10 feet.
  - a. Color-Coded Bands: Use vinyl color marking tape to mark bands 2 inches wide.
    - 1) Color Code:
      - (a) Life Safety Branch: Red with white letters, including voltage, i.e. "LIFE SAFETY 120/208 VOLTS".
      - (b) Critical Branch: Red with white letters, including voltage, i.e. "CRITICAL 208/120 VOLTS".
      - (c) Equipment System: Red with white letters, including voltage, i.e. "EQUIPMENT 120/208 VOLTS".
      - (d) Fire Alarm System: Red.
        - (1) Red colored EMT conduit with black letters "FIRE ALARM EMT" may be used in lieu of colored bands.
      - (e) Public Address System: Green and white.
      - (f) Telecommunications System: Blue.
      - (g) Security System: Blue and orange.
      - (h) Nurse Call System: Green.
      - (i) Control System: Blue and yellow.
    - 2) Vinyl Color Marking Tape: 2 inch wide, [www.tapebrothers.com](http://www.tapebrothers.com).

- (a) Wrap tape a minimum of 3 times around each individual conduit.

- 4. Use identification labels or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.

E. Identification for Boxes:

- 1. Use voltage markers to identify highest voltage present.
- 2. Use voltage markers to identify systems other than normal power system.
  - a. Color-Coded Boxes: Field-painted in accordance with Section 09 9000 per the same color code used for raceways.
- 3. Use identification labels to identify circuits enclosed.

## **2.2 IDENTIFICATION NAMEPLATES AND LABELS**

A. Identification Nameplates:

- 1. Materials:
  - a. Indoor Clean, Dry Locations: Use plastic nameplates.
  - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
- 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
- 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
- 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
- 5. Text height: 3/16 inches minimum.
- 6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

- 1. Materials: Use mechanical fasteners to apply laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
- 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
  - a. System designation where applicable:
  - b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
  - a. System Designation: 1 inch.
  - b. Equipment Designation: 1/2 inch.
5. Color:
  - a. Normal Power System: White text on black background.
  - b. Emergency Power System:
    - 1) Life Safety Branch: White text on red background.
    - 2) Critical Branch: White text on blue background.
    - 3) Equipment Branch: White text on green background.
  - c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.

5. Color: Black text on yellow background unless otherwise indicated.

### **2.3 WIRE AND CABLE MARKERS**

- A. Markers for Branch Circuit Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Feeder Conductors and Cables: Use metal tags on each circuit cables and wires to clearly designate their circuit identification and voltage.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.

### **2.4 VOLTAGE MARKERS**

- A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl or vinyl snap-around type markers.
  - 1. Seton Identification Products; Model M4883: [www.seton.com](http://www.seton.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- C. Minimum Size:
  - 1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
  - 2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
  - 3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- D. Legend:
  - 1. Markers for Voltage Identification: Highest voltage present.
  - 2. Markers for System Identification:



- a. Emergency System - Life Safety Branch: Text "LIFE SAFETY".
  - b. Emergency System - Critical Branch: Text "CRITICAL".
  - c. Equipment System: Text "EQUIPMENT".
- E. Color: Black text on orange background unless otherwise indicated.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

#### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
- 1. Surface-Mounted Equipment: Enclosure front.
  - 2. Flush-Mounted Equipment: Inside of equipment door.
  - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  - 4. Elevated Equipment: Legible from the floor or working platform.
  - 5. Branch Devices: Adjacent to device.
  - 6. Interior Components: Legible from the point of access.
  - 7. Boxes: Outside face of cover.
  - 8. Conductors and Cables: Legible from the point of access.
  - 9. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using stainless steel screws.
- 1. Do not use adhesives except where substrate cannot be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

Replace Building 50  
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### **3.3 FIELD QUALITY CONTROL**

- A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

- - - END - - -

**SECTION 26 24 16**  
**CIRCUIT BREAKERS AND PANELBOARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation, and connection of circuit breakers in existing panelboards.

**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): Cables and wiring.
- 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.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlet boxes.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Sufficient information, shall be clearly presented to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, and mounting details, w. Complete nameplate data, including manufacturer's name and catalog number.
- C. Manuals:
  - 1. When submitting the shop drawings, submit companion copies of complete maintenance and operating manuals, including technical data sheets.

2. If changes have been made to the maintenance and operating manuals that were originally submitted, then submit four copies of updated maintenance and operating manuals to the COR two weeks prior to final inspection.

D. Certification: Two weeks prior to final inspection, submit four copies of the following to the COR:

1. Certification by the contractor that the materials have been properly installed, connected, and tested.

### **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. National Electrical Manufacturers Association (NEMA):

PB-1-06..... Panelboards

250-08..... Enclosures for Electrical Equipment (1000V  
Maximum)

C. National Fire Protection Association (NFPA):

70-2005 ..... National Electrical Code (NEC)

70E-2004..... Standard for Electrical Life Safety in the  
Workplace

D. Underwriters Laboratories, Inc. (UL):

50-95..... Enclosures for Electrical Equipment

67-09..... Panelboards

489-09..... Molded Case Circuit Breakers and Circuit Breaker  
Enclosures

## **PART 2 - PRODUCTS**

### **2.1 PANELBOARDS**

A. Provide circuit breakers in existing panelboards as indicated.

### **2.2 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS**

A. Circuit breakers shall be per UL 489, in accordance with the NEC, as shown on the drawings, and as specified.

B. Circuit breakers in panelboards shall be bolt-on type.

C. Molded case circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:

1. 120/208 V Panelboard: 10,000 A symmetrical.
2. 120/208 V Distribution Panelboard: 22,000 A symmetrical (field verify and match existing equipment interrupting rating. Do not use series rating.

D. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 225 A frame or lower. .

E. 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.
8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.
9. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

### **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. Install a printed schedule of circuits in each panelboard after approval by the COR. Schedules shall be printed on the panelboard directory cards, installed in the appropriate existing panelboards, and incorporate all applicable contract changes. Information shall indicate outlets, lights,

devices, or other equipment controlled by each circuit, and the final room numbers served by each circuit.

- C. All panelboards labels shall be coordinated with the COR and will include the fed from panel identification and circuit breaker numbers.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

#### **1. Visual and Mechanical Inspection**

- a. Compare equipment nameplate data with specifications and approved shop drawings.
- b. Inspect physical, electrical, and mechanical condition.
- c. Verify appropriate anchorage and required area clearances.
- d. Verify that circuit breaker sizes and types correspond to approved shop drawings.
- e. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.
- f. Clean panelboard.

### **3.3 FOLLOW-UP VERIFICATION**

Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the existing panelboards and distribution panelboards are in good operating condition and properly performing the intended function.

- - - E N D - - -

**SECTION 26 27 17**  
**EQUIPMENT WIRING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Electrical connections to equipment.

**1.2 RELATED REQUIREMENTS**

- A. Section 26 05 21 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
- B. Section 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

**1.3 REFERENCE STANDARDS**

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections; and Government provided equipment.
  - 2. Determine connection locations and requirements.
- B. Sequencing:
  - 1. Obtain coordination requirements prior to rough-in for equipment.
  - 2. Install rough-in of electrical connections before installation of equipment is required.
  - 3. Make electrical connections before required start-up of equipment.

**1.5 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Disconnect Switches: As specified in Section 26 29 21.
- B. Wire and Cable: As specified in Section 26 05 21.
- C. Conduit, flexible conduit, and boxes: As specified in Section 26 05 33.

### **2.2 EQUIPMENT CONNECTIONS**

- A. Provide connections, devices, disconnect switches, etc., per schedule on the Drawings:

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

### **3.2 ELECTRICAL CONNECTIONS**

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using liquid-tight flexible conduit with watertight connectors.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- E. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

- - - END - - -



**SECTION 26 29 11**  
**MOTOR STARTERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

All motor starters and variable speed motor controllers, including installation and connection (whether furnished with the equipment specified in other Divisions or otherwise), shall meet these specifications.

**1.2 RELATED WORK**

- A. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
- 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 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 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, weights, mounting details, materials, running over current protection, size of enclosure, over current protection, wiring diagrams, starting characteristics, interlocking and accessories.
- C. 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 COR.
- D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certifications to the COR:
- 1. Certification that the equipment has been properly installed, adjusted, and tested.

#### 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 basic designation only.
- B. Institute of Electrical and Electronic Engineers (IEEE):
- 519..... Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
  - C37.90.1..... Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
- C. National Electrical Manufacturers Association (NEMA):
- ICS 1..... Industrial Control and Systems General Requirements
  - ICS 1.1..... Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
  - ICS 2..... Industrial Control and Systems, Controllers, Contactors and Overload Relays Rated 600 Volts DC
  - ICS 6..... Industrial Control and Systems Enclosures
  - ICS 7..... Industrial Control and Systems Adjustable-Speed Drives
  - ICS 7.1..... Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems

D. National Fire Protection Association (NFPA):

70..... National Electrical Code (NEC)

E. Underwriters Laboratories Inc. (UL):

508..... Industrial Control Equipment

## **PART 2 - PRODUCTS**

### **2.1 MOTOR STARTERS, GENERAL**

A. 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 COR, 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. Unless noted otherwise, equip with not less than two normally open and two normally closed auxiliary contacts. Provide green run pilot lights and H-O-A control devices as indicated, operable at front of enclosure without opening enclosure. Push buttons, selector switches, pilot lights, etc., shall be interchangeable.
- 8. Enclosures:
  - a. Shall be the NEMA types shown on the drawings for the motor controllers and shall be the NEMA types which are the most suitable for the environmental conditions where the motor controllers are being installed.
  - b. Doors mechanically interlocked to prevent opening unless the breaker or switch within the enclosure is open. Provision for padlock must be provided.
  - c. 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. Additional requirements for specific motor controllers, as indicated in other sections, shall also apply.
- F. Provide all wiring and conduit required to facilitate a complete installation.

## **2.2 MAGNETIC MOTOR STARTERS**

- A. Shall be in accordance with applicable requirements of 2.1 above.
- B. Starters shall be general-purpose, Class A magnetic controllers for induction motors rated in horsepower.

- 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.
- E. Unless otherwise indicated, provide full voltage non-reversing across-the-line mechanisms for motors less than 75 HP, closed by coil action and opened by gravity. Equip starters with 24V DC coils and individual control transformer unless otherwise noted. Locate "reset" button to be accessible without opening the enclosure.
- F. 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.

### **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. Furnish and install heater elements in motor starters and to match the installed motor characteristics. Submit a list of all motors listing motor nameplate rating and heater element installed.
- C. Motor Data: Provide neatly-typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, voltage/phase rating and heater element installed.
- D. Connect hand-off auto selector switches so that automatic control only is by-passed in "manual" position and any safety controls are not by-passed.

#### **3.2 ADJUSTING**

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust at six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes

(or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify COR before increasing settings.

### **3.3 ACCEPTANCE CHECKS AND TESTS**

A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

#### **1. Visual and Mechanical Inspection**

- a. Compare equipment nameplate data with specifications and approved shop drawings.
- b. Inspect physical, electrical, and mechanical condition.
- c. Inspect contactors.
- d. Clean motor starters.
- e. Verify overload element ratings are correct for their applications.
- f. If motor-running protection is provided by fuses, verify correct fuse rating.
- g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

### **3.4 FOLLOW-UP VERIFICATION**

Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the motor starters are in good operating condition and properly performing the intended functions.

### **3.5 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.

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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. 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: Cables and wiring.
- 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 faults.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
- E. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS: Motor Starters.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, mounting details, materials, enclosure types, and fuse types and classes.
  - 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 COR two weeks prior to final inspection.
  2. Terminals on wiring diagrams shall be identified to facilitate maintenance and operation.
  3. Wiring diagrams shall indicate internal wiring and any interlocking.
- D. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the COR:
1. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
  2. Certification by the contractor that the materials have been properly installed, connected, and tested.

#### **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. National Electrical Manufacturers Association (NEMA):
- FU 1-07..... Low Voltage Cartridge Fuses
- KS 1-06..... Enclosed and Miscellaneous Distribution Equipment  
Switches (600 Volts Maximum)
- C. National Fire Protection Association (NFPA):
- 70-08..... National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
- 98-04..... Enclosed and Dead-Front Switches
- 248-00..... Low Voltage Fuses
- 977-94..... Fused Power-Circuit Devices

### **PART 2 - PRODUCTS**

#### **2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 600 AMPERES AND LESS**

- A. In accordance with UL 98, NEMA KS1, and NEC.
- B. Shall have NEMA classification General Duty (GD) for 240 V switches.
- C. Shall be HP 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 have lock-open padlocking provisions.
5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable 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 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 most suitable for the ambient environmental conditions. 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**

Shall be the same as Low Voltage Fusible Switches Rated 600 Amperes and Less, but without provisions for fuses.

## **2.5 LOW VOLTAGE CARTRIDGE FUSES**

- A. In accordance with NEMA FU1.
- B. Feeders: Class RK1, time delay.
- C. Motor Branch Circuits: Class RK1, time delay.
- D. Control Circuits: Class CC, time delay.

## **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.  
Arrange fuses such that rating information is readable without removing the fuse.
- C. Label each disconnect with the fed from panel identification and circuit breaker numbers, as well as the equipment it serves.

### **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 COR.

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