

SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

Unit heaters, fan coil units, and finned-tube radiation.

1.2 RELATED WORK

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- B. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT: Noise requirements.
- C. Section 23 21 13, HYDRONIC PIPING: Heating hot water and chilled water piping.
- D. Section 23 31 00, HVAC DUCTS AND CASINGS: Ducts and flexible connectors.
- E. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Valve operators.
- F. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC: Flow rates adjusting and balancing.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Fan Coil Units
 - 2. Unit heaters.
 - 3. Finned-tube radiation. C.
- Certificates:
 - 1. Compliance with paragraph, QUALITY ASSURANCE.
 - 2. Compliance with specified standards.
- D. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

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

B. Air Conditioning and Refrigeration Institute (ARI):

440-05.....Room Fan Coils

C. National Fire Protection Association (NFPA):

90A-02.....Standard for the Installation of Air
Conditioning and Ventilating Systems

70-05.....National Electrical Code

D. Underwriters Laboratories, Inc. (UL):

181-05.....Standard for Factory-Made Air Ducts and Air
Connectors

1995-05.....Heating and Cooling Equipment

1.6 GUARANTY

In accordance with Section 00 72 00, GENERAL CONDITIONS.

PART 2 - PRODUCTS

2.1 ROOM FAN-COIL UNITS

A. Capacity Certification: ARI 440.

B. Safety Compliance: NEC compliant and UL listed.

C. Noise Levels: Operating at full cooling capacity, sound power level shall not exceed by more than 5 dB the numerical value of sound pressure levels associated with noise criteria specified in Section 230541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Select units at intermediate speed, for compliance with the noise criteria.

D. Chassis: Galvanized steel, acoustically and thermally insulated to attenuate noise and prevent condensation.

E. Cabinet Type: Not lighter than 1.3 mm (18 gage) steel, reinforced and braced. Arrange components and provide adequate space for installation of piping package and control valves. Finish shall be galvanized G-90. 1.

Concealed Units: Enclosed type with inlet and outlet duct collars.

F. Fans: Centrifugal, direct drive, galvanized steel or polyester resin.

1. Motors: 3-speed permanent split capacitor type with integral thermal overload protection, for operation at not more than 1200 RPM.

2. Provide a fan speed selector switch, with off, low, medium, and high positions. Switch shall have a set of auxiliary contacts which are

open when the switch is in the "off" position and closed when the switch in any of the other positions. On vertical units, mount switch in a junction box in the cabinet of each unit. On horizontal units, switch shall be wall mounted. G.

Cooling and Heating Coils:

1. Hydronic (two separate coils for cooling and heating): Copper tubes, 10 mm (three-eighths inch) minimum inside diameter, not less than 4.3 mm (0.017 inch) thick with copper or aluminum fins. Coils shall be pressure tested for bursting and strength in accordance with Underwriters Laboratories, Inc., requirements for pressure tested coils, and shall be designed to provide adequate heat transfer capacity. Provide manual air vent at high point of each coil and drain at each low point.

2. Auxiliary steam coils: Serpentine copper tube mechanically bonded to aluminum fins, maximum working pressure 1378 kPa (200 psig).

3. Electrical heating coils: Spiral sheath or finned-tube construction with Cal-rod resistance elements in aluminum tubes. Units shall be UL listed and factory wired with unit mounted heat switch, magnetic contactors, high temperature cutout safety control, and fan override thermostat.

H. Piping Package: Furnished with unit by the manufacturer to fit control valves provided by the controls supplier. Submit manufacturer's detailed drawings of the piping in the end compartments for approval prior to fabrication of the piping packages. Provide ball stop valves on the supply and return pipes and balancing fittings on the return pipes.

I. Drain pans: Furnish galvanized steel with solderless drain connections and molded polystyrene foam insulating liner:

1. Auxiliary drain pan: Located under control valve and piping to prevent dripping.

J. Air Filter: Manufacturer's standard throwaway type, not less than one inch thick MERV 8, supported to be concealed from sight and be tight fitting to prevent air by-pass. Filters shall have slide out frames and be easily replaced without removing enclosure or any part thereof.

K. Control valves and unit mounted return air thermostats are to be field installed.

2.2 UNIT HEATERS

- A. General: Horizontal or vertical discharge type for steam, hot water or electric heating medium, as indicated.
- B. Casing: Steel sheet, phosphatized to resist rust and finished in baked enamel. Provide hanger supports.
- C. Fan: Propeller type, direct driven by manufacturer's standard electric motor. Provide resilient mounting. Provide fan guard for horizontal discharge units.
- D. Discharge Air Control:
 - 1. Horizontal discharge: Horizontal, adjustable louvers.
 - 2. Vertical discharge: Radial louver diffuser.
- E. Steam or Hot Water Coil: Aluminum fins bonded to seamless copper tubing by mechanical expansion of the tubing, designed for 517 kPa (75 psig) steam working pressure.

2.2 FINNED-TUBE RADIATION

- A. Ratings: Certified under the I=B=R program of the Gas Appliance Manufacturer's Association.
- B. Enclosures: 1.6 mm (16 gage) steel, sloping top, designed for wall mounting. Provide baked enamel finish in standard manufacturer's colors as selected by the Architect. End plates and corner pieces shall be die-formed with round edges and fit flush with enclosure surface. Where continuous wall-to-wall installations are shown on the drawings provide all fillers, corner fittings, sleeves, end caps and other accessories, which shall have the same profile as the basic unit. Provide access panels or extensions where required for access to valves, or traps shown on the drawings.
- C. Hydronic/Steam Heating Elements: Steel pipe or nonferrous tubing with fins mechanically bonded by mechanical expansion of the tube. Elements shall be positively positioned front-to-back with provisions for silent horizontal expansion and contraction.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.
- B. Handle and install units in accordance with manufacturer's written instructions.

VAIC HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
10-07M

C. Support units rigidly so they remain stationary at all times.
Cross-bracing or other means of stiffening shall be provided as
necessary. Method of support shall be such that distortion and
malfunction of units cannot occur.

D. Install fiberglass blanket insulation above hydronic radiant panels.

3.2 OPERATIONAL TEST

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

- - - E N D - - -

VAIC HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
10-07M

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 82 16
AIR COILS

PART 1 - GENERAL

1.1 DESCRIPTION

Heating and cooling coils for air handling unit applications

1.2 RELATED WORK

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Section 23 31 00, HVAC DUCTS AND CASINGS
- C. Section 23 36 00, AIR TERMINAL UNITS: Reheat coils for VAV/CV terminals.
- D. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.
- E. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS

1.3 QUALITY ASSURANCE

- A. Refer to paragraph, QUALITY ASSURANCE, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Unless specifically exempted by these specifications, heating and cooling coils shall be tested, rated, and certified in accordance with AHRI Standard 410 and shall bear the AHRI certification label.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA. B. Manufacturer's Literature and Data for Heating and Cooling Coils: Submit type, size, arrangements and performance details. Present application ratings in the form of tables, charts or curves.
- C. Provide installation, operating and maintenance instructions.
- D. Certification Compliance: Evidence of listing in current ARI Directory of Certified Applied Air Conditioning Products.
- E. Coils may be submitted with Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS, Section 23 36 00, AIR TERMINAL UNITS, or Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning and Refrigeration Institute (AHRI):
Directory of Certified Applied Air Conditioning Products
AHRI 410-01.....Forced-Circulation Air-Cooling and Air-Heating Coils
- C. American Society for Testing and Materials (ASTM):
B75/75M-02.....Standard Specifications for Seamless Copper Tube
- D. National Fire Protection Association (NFPA):

70-11.....National Electric Code

E. National Electric Manufacturers Association (NEMA):

250-11.....Enclosures for Electrical Equipment (1,000 Volts
Maximum)

F. Underwriters Laboratories, Inc. (UL):

1996-09.....Electric Duct Heaters

PART 2 - PRODUCTS

2.1 HEATING AND COOLING COILS

A. Conform to ASTM B75 and AHRI 410.

B. Tubes: Minimum 16 mm (0.625 inch) tube diameter; Seamless copper tubing. C. Fins: 0.1397 mm (0.0055 inch) aluminum or 0.1143 mm (0.0045 inch) copper mechanically bonded or soldered or helically wound around tubing.

D. Headers: Copper, welded steel or cast iron. Provide seamless copper tubing or resistance welded steel tube for volatile refrigerant coils.

E. "U" Bends, Where Used: Machine die-formed, silver brazed to tube ends. F.

Coil Casing: 1.6 mm (16 gage) galvanized steel with tube supports at 1200 mm (48 inch) maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.

G. Pressures kPa (PSIG):

Pressure	Water Coil	Steam Coil	Refrigerant Coil
Test	2070 (300)	1725 (250)	2070 (300)
Working	1380 (200)	520 (75)	1725 (250)

H. Protection: Unless protected by the coil casing, provide cardboard, plywood, or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.

I. Vents and Drain: Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing. Coils to be fully drainable.

J. Cooling Coil Condensate Drain Pan: Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

K. Steam Distributing Coils: Conform to ASTM B75 and ARI 410. Minimum 9.5 mm (3/8-inch) steam distributing tubing installed concentrically in 25 mm (one-inch) OD condensing coil tubes.

L. Integral Face and Bypass Type Steam Coil:

1. Exempt from ARI Test and Certification.

2. Conform to ASTM B75 and ARI 410.

3. Minimum 16 mm (5/8-inch) steam tube installed in concentrically 25 mm (one-inch) OD diameter tube.

- 4. Casing: 1.9 mm (14 gage) galvanized steel with corrosion resistant paint.
- 5. Tubes and Bypasses: Vertical or horizontal.
- M. Dampers: Interlocking opposed blades to completely isolate coil from air flow when unit is in bypass position; 1.6 mm (16 gage) steel, coated with factory applied corrosion resistant baked enamel finish. Provide damper linkage and electric operators. Damper operators shall be of same manufacturer as controls furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

2.2 REHEAT COILS

The coils shall be continuous circuit booster type for steam or hot water as shown on drawings. Use the same coil material as listed in Paragraphs 2.1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Follow coil manufacturer's instructions for handling, cleaning, installation and piping connections.
- B. Comb fins, if damaged. Eliminate air bypass or leakage at coil sections.

3.2 STARTUP AND TESTING

- A. The Project Manager will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Project Manager. Provide a minimum of 7 days prior notice.

3.3 DEMONSTRATION AND TRAINING

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

- - - E N D - - -

VAIC HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
04-11

THIS PAGE INTENTIONALLY LEFT BLANK

Division 26

Electrical

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchboards, panelboards, and other items and arrangements for the specified items are shown on drawings.
- C. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

- A. References to the International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

- A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
 - 1. Listed; Equipment, 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.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

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

1.6 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.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Project Manager a minimum of 15 working days prior to the manufacturers making the factory tests.

2. Four copies of certified test reports containing all test data shall be furnished to the Project Manager prior to final inspection and not more than 90 days after completion of the tests.

3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.7 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with Section 00 72 00, GENERAL CONDITIONS and Section 01 33

23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 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 switchgear, switchboards, panelboards, transformers, motor control centers, motor controllers, uninterruptible power systems, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, 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 Project Manager, 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.

1.9 WORK PERFORMANCE

A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:

1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.

2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.

3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the Project Manager 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 Project Manager.

D. 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.

E. 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.

F. Coordinate location of equipment and conduit with other trades to minimize interferences.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces shall not be less than specified in the NEC for all voltages specified.

C. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.

2. "Conveniently accessible" is defined as being capable of being reached 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.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers (starters), fused and unfused safety switches, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards,

switchgear and motor control assemblies, control devices and other significant equipment.

B. Nameplates for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Nameplates for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 1/2 inch [12mm] high. Nameplates shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm²), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

1.12 SUBMITTALS

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

B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION _____".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer.

F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
 - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
 - b. A control sequence describing start-up, operation, and shutdown.
 - c. Description of the function of each principal item of equipment.
 - d. Installation instructions.
 - e. Safety precautions for operation and maintenance.
 - f. Diagrams and illustrations.
 - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers and replacement frequencies.
 - h. Performance data.

i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list

shall indicate sources of supply, recommended spare parts, and name of servicing organization.

j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of manuals together with shop drawings.

H. After approval and prior to installation, furnish the Project Manager with one sample of each of the following:

1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.

2. Each type of conduit coupling, bushing and termination fitting.

3. Conduit hangers, clamps and supports.

4. Duct sealing compound.

5. Each type of receptacle, toggle switch, occupancy sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 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.

1.14 ACCEPTANCE CHECKS AND TESTS

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

1.15 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 Project Manager at least 30 days prior to the planned training.

- - - E N D - - -

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 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 Project Manager:
 - 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):

70-08.....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.

2. All cabling not installed in conduit shall be provided with a plenum- rated
jacket.

D. Color Code:

1. Secondary service feeder and branch circuit conductors shall be color-
coded as follows:

208/120 volt	Phase	480/277 volt
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

a. Lighting circuit "switch legs" shall match the color of the serving voltage and 3-way switch "traveling wires" shall be purple. Coordinate color coding in the field with the Project Manager prior to installation.

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.

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, pull-boxes, etc.
- 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 Project Manager.
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

- A. 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. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.

3.4 EXISTING WIRING

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

3.5 CONTROL AND SIGNAL WIRING INSTALLATION

- A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to

supply such systems and have suitable spare circuit breakers or space for installation.

3.6 CONTROL AND SIGNAL SYSTEM WIRING IDENTIFICATION

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.7 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. Existing conductors to be reused shall also be tested.
- 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.
- C. Perform phase rotation test on all three-phase circuits.
- D. The contractor shall furnish the instruments, materials, and labor for all tests.

- - - E N D - - -

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 22 00, LOW-VOLTAGE TRANSFORMERS: Low voltage transformers. D. Section 26 24 16, PANELBOARDS: Low voltage panelboards.

E. Section 26 41 00, FACILITY LIGHTNING PROTECTION: Requirements for lightning protection.

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 enough information to determine compliance with drawings and specifications.

2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

C. Test Reports: Provide certified test reports of ground resistance.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Project Manager:

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.

1.5 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):

44-05Thermoset-Insulated Wires and Cables

83-08Thermoplastic-Insulated Wires and Cables

467-07Grounding and Bonding Equipment

486A-486B-03Wire 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 mm²] 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 mm²] and larger shall be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG [6 mm²] 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.

2.2 GROUND CONNECTIONS

A. Below Grade: Exothermic-welded type connectors. B.

Above Grade:

1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.

2.3 EQUIPMENT RACK AND CABINET GROUND BARS

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 0.375 in [4 mm] thick x 0.75 in [19 mm] wide.

2.4 GROUND TERMINAL BLOCKS

At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.5 GROUNDING BUS

Pre-drilled rectangular copper bar with stand-off insulators, minimum 0.25 in [6.3 mm] thick x 4 in [100 mm] high in cross-section, length as shown on drawings, with 0.281 in [7.1 mm] holes spaced 1.125 in [28 mm] apart.

PART 3 - EXECUTION

3.1 GENERAL

A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.

2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

D. Special Grounding: For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections, which are normally buried or otherwise inaccessible (except connections for which access for periodic testing is required), by exothermic weld.

3.3 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building steel, and supplemental or made electrodes. Provide jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.

2. Provide a supplemental ground electrode and bond to the grounding electrode system.

C. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.

D. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers and Panelboards, Engine-Generators, and Automatic Transfer Switches:

1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.

2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.

3. Provide ground bars, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

4. Connect metallic conduits that terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

E. Transformers:

1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary.

Provide a grounding electrode at the transformer.

2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system.

3.4 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.

Wireway Systems:

1. Bond the metallic structures of wireway to provide 100% electrical continuity throughout the wireway system, by connecting a No. 6 AWG [16 mm²] bonding jumper at all intermediate metallic enclosures and across all section junctions.

2. Install insulated No. 6 AWG [16 mm²] bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 50 ft [16 M].

3. Use insulated No. 6 AWG [16 mm²] bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.

4. Use insulated No. 6 AWG [16 mm²] bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 49 ft [15 M].

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

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

H. Raised Floors: Provide bonding of all raised floor components. See details on the drawings.

I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG [16 mm²]. These conductors shall be installed in rigid metal conduit.

3.5 CORROSION INHIBITORS

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.6 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

B. In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping at the outlets directly to the room or patient ground bus.

3.7 LIGHTNING PROTECTION SYSTEM

Bond the lightning protection system to the electrical grounding electrode system.

3.8 ELECTRICAL ROOM GROUNDING

Building Earth Ground Busbars: Provide ground busbar and mounting hardware at each electrical room and connect to pigtail extensions of the building grounding ring.

3.9 EXTERIOR LIGHT POLES

Provide 20 ft [6.1 M] of No. 4 bare copper coiled at bottom of pole base excavation prior to pour, plus additional unspliced length in and above foundation as required to reach pole ground stud.

3.10 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Services at power company interface points shall comply with the power company ground resistance requirements.

D. Below-grade connections shall be visually inspected by the Project Manager prior to backfilling. The contractor shall notify the Project Manager 24 hours before the connections are ready for inspection.

3.11 GROUND ROD INSTALLATION

- A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 24 in [609 mm] below final grade.
- B. For indoor installations, leave 4 in [100 mm] of rod exposed.
- C. Where permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.
- D. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

- - - E N D - - -

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets. B. Section 07 60 00, FLASHING AND SHEET METAL: Fabrications for the deflection of water away from the building envelope at penetrations.

C. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.

D. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

E. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.

F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

G. 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. Manufacturer's Literature and Data: Showing each cable type and rating. The specific item proposed and its area of application shall be identified on the catalog cuts.

B. Shop Drawings:

1. Size and location of main feeders.

2. Size and location of panels and pull-boxes.

3. Layout of required conduit penetrations through structural elements. C.
Certifications:

1. Two weeks prior to the final inspection, submit four copies of the following certifications to the Project Manager:
 - 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.

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 [19 mm] unless otherwise shown.

B. Conduit:

1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
2. Rigid aluminum: Shall conform to UL 6A and ANSI C80.5.
3. Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
4. 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.
5. Flexible galvanized steel conduit: Shall conform to UL 1.
6. Liquid-tight flexible metal conduit: Shall conform to UL 360.
7. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
8. Surface metal raceway: Shall conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
 - a. Fittings shall meet the requirements of UL 514B and 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. Rigid aluminum conduit fittings:

a. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4% copper are prohibited.

b. Locknuts and bushings: As specified for rigid steel and IMC conduit.

c. Set screw fittings: Not permitted for use with aluminum conduit.

3. Electrical metallic tubing fittings:

a. Fittings 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. Setscrew couplings and connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding.

d. Indent-type connectors or couplings are prohibited.

e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

4. Flexible steel conduit fittings:

a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.

b. Clamp-type, with insulated throat.

5. Liquid-tight flexible metal conduit fittings:

a. Fittings shall meet the requirements of UL 514B and 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.

d. All connections (line voltage and low voltage) to systems furniture shall be by gray liquid-type flexible metal conduit.

6. Direct burial plastic conduit fittings:

Fittings shall meet the requirements of UL 514C and NEMA TC3.

7. Surface metal raceway fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.

8. 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. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.
 - 5. Floor boxes shall be fire rated poke-through style supplied with one(1) duplex receptacle and four(4) voice/data ports. The poke-through device shall be equal to Hubbell SystemOne with 6" recessed access.

Coordinate cover material and finish with Architect prior to installation.
- F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

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 Project Manager 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 Project Manager 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 (Emergency) raceway systems shall be entirely independent of other raceway systems, except where shown on drawings.

C. Install conduit as follows:

1. In 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. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
12. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
13. Do not use aluminum conduits in wet locations.
14. Aluminum conduit and fittings, etc shall be used in all MRI and future MRI spaces. Ferrous materials are not permitted in MRI areas.

D. Conduit Bends:

1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited. E.

Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown 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 Project Manager.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only:
 - a. Where shown on the structural drawings.
 - b. As approved by the Project Manager prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 3 in [75 mm] thick is prohibited.

- a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
- b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
- c. Install conduits approximately in the center of the slab so that there will be a minimum of 0.75 in [19 mm] of concrete around the conduits.
- 5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.
- B. Above Furred or Suspended Ceilings and in Walls:
 - 1. Conduit for conductors 600 V and below: Rigid steel, IMC, rigid aluminum, or EMT. Mixing different types of conduits indiscriminately in the same system is prohibited.
 - 3. Align and run conduit parallel or perpendicular to the building lines.
 - 4. Connect recessed lighting fixtures to conduit runs with maximum 6 ft [1.8 M] of flexible metal conduit extending from a junction box to the fixture.
 - 5. Tightening setscrews with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors 600 V and Below: Rigid steel, IMC, rigid aluminum, 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: Use only where shown.
- G. Painting:
 - 1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
 - 2. Paint all conduits containing cables rated over 600 V safety orange.Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 2 in [50 mm] high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 20 ft [6 M] intervals in between.

3.5 WET OR DAMP LOCATIONS

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.
- C. Unless otherwise shown, use rigid steel or IMC conduit within 5 ft [1.5 M] of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

3.6 MOTORS AND VIBRATING EQUIPMENT

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. 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.

3.7 EXPANSION JOINTS

- A. Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 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 3in [76 mm] and larger are acceptable.
- C. Install expansion and deflection couplings where shown.

3.8 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.

3.9 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. Each junction box cover and pullbox cover shall be provided with black indelible marker labeling identifying the wiring branch (Critical, Normal, Equipment, etc), the panelboard and the circuit(s) contained within the box.

Markings for covers in finished spaces shall be placed on the interior face of the cover.

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
09-10

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of low-voltage dry-type general-purpose transformers, indicated as transformers in this section.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:

Requirements that apply to all sections of Division 26.

B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:

Low-voltage conductors.

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: Conduit.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:

a. Submit sufficient information to demonstrate compliance with drawings and specifications.

b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, temperature rise, wiring and connection diagrams, plan, front, side, and rear elevations, accessories, and device nameplate data.

2. Manuals:

a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets and wiring diagrams.

1) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the transformers.

- 2) Include information for testing, repair, troubleshooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
 - a. Certification by the manufacturer that the transformers conform to the requirements of the drawings and specifications.
 - b. Certification by the Contractor that the transformers have 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 designation only.

B. International Code Council (ICC):

IBC-12.....International Building Code

C. National Fire Protection Association (NFPA):

70-11.....National Electrical Code (NEC) D.

National Electrical Manufacturers Association (NEMA):

TP1-02.....Guide for Determining Energy Efficiency for
Distribution Transformers

TR1-00.....Transformers, Regulators, and Reactors

E. Underwriters Laboratories, Inc. (UL):

UL 506-08.....Standard for Specialty Transformers

UL 1561-11.....Dry-Type General Purpose and Power Transformers

F. United States Department of Energy

10 CFR Part 431.....Energy Efficiency Program for Certain
Commercial and Industrial Equipment

PART 2 - PRODUCTS

2.1 TRANSFORMERS

A. Unless otherwise specified, transformers shall be in accordance with NEMA, NEC, UL and as shown on the drawings.

B. Transformers shall have the following features:

1. Self-cooled by natural convection, isolating windings, indoor dry- type. Autotransformers will not be accepted, except as specifically allowed for buck-boost applications.
2. Rating and winding connections shall be as shown on the drawings.
3. Ratings shown on the drawings are for continuous duty without the use of cooling fans.
4. Copper windings.
5. Insulation systems:
 - a. Transformers 30 kVA and larger: UL rated 220 °C (428 °F) system with an average maximum rise by resistance of 150 °C (302 °F) in a maximum ambient of 40 °C (104 °F).
 - b. Transformers below 30 kVA: Same as for 30 kVA and larger or UL rated 185 °C (365 °F) system with an average maximum rise by resistance of 115 °C (239 °F) in a maximum ambient of 40 °C (104 °F).
6. Core and coil assemblies:
 - a. Rigidly braced to withstand the stresses caused by short-circuit currents and rough handling during shipment.
 - b. Cores shall be grain-oriented, non-aging, and silicon steel.
 - c. Coils shall be continuous windings without splices except for taps.
 - d. Coil loss and core loss shall be minimized for efficient operation.
 - e. Primary and secondary tap connections shall be brazed or pressure type.
 - f. Coil windings shall have end filters or tie-downs for maximum strength.
7. Certified sound levels, determined in accordance with NEMA, shall not exceed the following:

Transformer Rating	Sound Level Rating
0 - 9 KVA	40 dB
10 - 50 KVA	45 dB
51 - 150 KVA	50 dB
151 - 300 KVA	55 dB
301 - 500 KVA	60 dB

8. If not shown on drawings, nominal impedance shall be as permitted by NEMA.
9. All transformers rated 30 kVA and larger shall have two 2.5% full capacity taps above, and four 2.5% full capacity taps below normal rated primary voltage.
10. Core assemblies shall be grounded to their enclosures with adequate flexible ground straps.
11. Enclosures:
- a. Comprised of not less than code gauge steel.
 - b. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.
 - c. Ventilation openings shall prevent accidental access to live components.
 - d. The enclosure at the factory shall be thoroughly cleaned and painted with manufacturer's prime coat and standard finish.
12. Standard NEMA features and accessories, including ground pad, lifting provisions, and nameplate with the wiring diagram and sound level indicated.
13. Dimensions and configurations shall conform to the spaces designated for their installations.
14. Transformers shall meet the minimum energy efficiency values per NEMA TP1 as listed below:

kVA Rating	Output efficiency (%)
15	97
30	97.5
45	97.7
75	98
112.5	98.2
150	98.3
225	98.5
300	98.6

500	98.7
750	98.8

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of transformers shall be in accordance with the NEC, as recommended by the equipment manufacturer and as shown on the drawings.
- B. Each transformer shall be installed on a 3 1/2" high concrete housekeeping pad, with a 3" extension on each side of the transformer. Anchor transformers with rustproof bolts, nuts, and washers, in accordance with manufacturer's instructions, and as shown on drawings.
- C. Install transformers with manufacturer's recommended clearance from wall and adjacent equipment for air circulation. Minimum clearance shall be 150 mm (6 inches).
- D. Install transformers on vibration pads designed to suppress transformer noise and vibrations.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Perform tests in accordance with the manufacturer's recommendations. In addition, include the following:
1. Visual Inspection and Tests:
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical and mechanical condition.
 - c. Inspect all field-installed bolted electrical connections, using the calibrated torque-wrench method to verify tightness of accessible bolted electrical connections.
 - d. Perform specific inspections and mechanical tests as recommended by manufacturer.
 - e. Verify correct equipment grounding.
 - f. Verify proper secondary phase-to-phase and phase-to-neutral voltage after energization and prior to connection to loads.

3.3 FOLLOW-UP VERIFICATION

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

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
12-01-12

- - - END - - -

SECTION 26 23 00
LOW-VOLTAGE SWITCHGEAR

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of a new switchboard section, drawout power-style circuit breaker(s), wiring, mounting hardware, Square D Struxurware Power Monitoring System and miscellaneous equipment to be added to existing Square D low voltage Switchboard USS9 located in Room BW116.

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 fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and outlet boxes.

1.3 QUALITY ASSURANCE

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

1.4 FACTORY TESTS

- A. Low-voltage switchgear shall be thoroughly tested at the factory to assure that there are no electrical or mechanical defects. Tests shall be conducted as per UL and ANSI Standards. Factory tests shall be certified.
- B. Thoroughly test the switchgear at the factory with the circuit breakers in the connected position in their cubicles. The factory tests shall be in accordance with C37.20 and ANSI C37.51 and shall include the following tests:
 - 1. Design Tests
 - 2. Production Tests
 - 3. Conformance Tests
- C. The following additional tests shall be performed:

1. Verify that circuit breaker sizes and types correspond to drawings and coordination study.
 2. Verify tightness of bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 3. Confirm correct operation and sequencing of electrical and mechanical interlock systems by attempting closure on locked-open devices, and attempting to open locked-closed devices, and making key exchange with devices operated in off-normal positions.
 4. Verify correct barrier and shutter installation and operation.
 5. Exercise all active components.
 6. Inspect indicating devices for correct operation.
 7. Perform a dielectric withstand voltage test on each bus section, each phase-to-ground with phases not under test grounded, in accordance with manufacturer's published data.
 8. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 volts dc for 300-volt rated cable and 1000 volts dc for 600-volt rated cable, or as required if solid-state components or control devices cannot tolerate the applied voltage.
 9. If applicable, verify correct function of control transfer relays located in the switchgear with multiple control power sources.
 10. Perform phasing checks on double-ended or dual-source switchgear to insure correct bus phasing from each source.
- D. Furnish four (4) copies of certified manufacturer's factory test reports to the Project Manager prior to shipment of the switchgear to ensure that the switchgear has been successfully tested as specified.

1.5 SUBMITTALS

A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, wiring and connection diagrams, plan, front, side, and rear elevations, sectional views, bus work, circuit breaker frame sizes, trip and short-circuit

rating, long-time, short-time, instantaneous and ground fault settings, coordinated breaker and fuse curves, accessories, and device nameplate data.

3. Show the size, ampere-rating, number of bars per phase and neutral in each bus run (horizontal and vertical), bus spacing, equipment ground bus, and bus material.

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 the interconnection between the items of equipment.

c. Provide a clear and concise description of operation, which gives, in detail, the information required to properly operate the equipment.

d. Approvals will be based on complete submissions of manuals together with shop drawings.

2. Two weeks prior to final inspection, deliver four copies of the final updated maintenance and operating manuals to the Project Manager.

a. The manuals shall be updated to include any information necessitated by shop drawing approval.

b. Complete "As Installed" wiring and schematic diagrams shall be included which show all items of equipment and their interconnecting wiring.

c. Show all terminal identification.

d. Include information for testing, repair, trouble shooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.

e. Provide a replacement and spare parts list. Include a list of tools and instruments for testing and maintenance purposes.

f. Furnish manuals in loose-leaf binder or manufacturer's standard binder.

D. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following to the Project Manager.

a. Certification by the Contractor that the assemblies have been properly installed, adjusted and tested, including circuit breaker settings.

b. Certified copies of all of the factory design and production tests, field test data sheets and reports for the assemblies.

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 referenced in the text by basic designation only.

B. Institute of Engineering and Electronic Engineers (IEEE):

C37.13.....Low Voltage AC Power Circuit Breakers Used in
Enclosures

C37.20.1.....Standard for Metal-Enclosed Low-Voltage Power
Circuit-Breaker Switchgear C57.13.....Instrument Transformers

C62.41.....Surge Voltage in Low Voltage AC Power Circuits

C. National Electrical Manufacturers Association (NEMA):

SG-3.....Low Voltage Power Circuit Breakers. SG-
5.....Power Switchgear Assemblies.

D. National Fire Protection Association (NFPA):

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

Underwriters Laboratories, Inc. (UL):

UL 891Dead-Front Switchboards

977.....Safety Fused Power Circuit Devices

1053.....Ground Fault Sensing and Relaying Equipment

UL 1558.....Metal-Enclosed Low-Voltage Power Circuit
Breaker Switchgear

PART 2 - PRODUCTS

2.1 GENERAL

A. Low voltage switchgear shall be in accordance with IEEE, NEMA, NFPA and UL.

B. Provide complete switchgear including, but not limited to housing, buses, draw out air circuit breaker(s), instruments and related transformers, relays fuses and wiring.

C. Switchgear dimensions shall not exceed the dimensions shown on the drawings.

D. Manufacturer's nameplate shall include complete ratings of switchgear in addition to date of manufacture.

E. The new switchboard section shall be fully prepared with all hardware, cradles, wiring, Struxurware Power Monitoring System cabling, etc and miscellaneous provisions to accommodated the future addition of three 800 Amp frame drawout circuit breakers.

2.2 HOUSING

A. Construction: Provide housing of structural or formed steel frame braced to maintain alignment and resist damage during shipment, erection, and by stresses resulting from short circuits. Enclose the frame on all sides, top, and bottom (except cable compartment) with sheet steel covers, doors and panels and equip with interior barriers. Provide rear access panels of the hinged type with provisions for padlocking. Provide ventilating louvers where required to limit the temperature rise of current carrying parts. Provide breakers with hinged covers and cutouts for control mechanism. Protect all openings against entrance of falling dirt, water or foreign matter. Isolate each breaker in its own compartment. Metering transformers and instruments shall be similarly isolated.

B. Painting: Enclosure shall be thoroughly cleaned, phosphate treated and primed by a phosphate or similar treatment, and followed immediately with a rust-inhibiting paint. Final finish coat shall be the manufacturers standard gray.

C. Breaker Compartments: The breaker compartments shall include stationary primary contacts, stationary secondary contacts as required, barriers, and rails for the drawout elements.

D. Auxiliary Compartments: Match and align with basic switchgear assembly. Include the following:

1. Bus transition sections.
2. Incoming-line pull sections.
3. Hinged front panels for access to metering, accessory, and blank compartments.
4. Pull box on top of switchgear for extra room for pulling cable, with removable top, front, and side covers and ventilation provisions

adequate to maintain air temperature in pull box within same limits as switchgear.

- a. Set pull box back from front to clear circuit-breaker lifting mechanism.
- b. Bottom: Insulating, fire-resistant material with separate holes for cable drops into switchgear.
- c. Cable Supports: Arranged to ease cabling and adequate to support cables indicated, including those for future installation.
- E. Louvers equipped with insect and rodent screen and filter; arranged to permit air circulation while excluding insects, rodents, and exterior dust.

2.3 BUSES

A. General: Arrange buses for 3 phase, 4 wire distribution. The phase buses (through bus), neutral bus, and ground bus shall be full capacity and shall extend the entire length of the switchgear. Make provisions for future extensions by means of bolt holes or other approved method. Brace bus to withstand short circuit current available at the particular location.

B. Material and Size: Buses and connections shall be hard-drawn copper of 98 percent conductivity. Bus size and arrangement shall be such that the temperature rise of the buses shall not exceed IEEE standards. Bus connections to circuit breakers shall be copper. Bus size shall match the existing feeder section adjacent the new section. Bus laminations shall have a minimum of 1/4 inch [6mm] spacing. The AIC rating of the new section shall be a minimum of 65,000 Amps.

C. Bus Connections: Provide bolted or welded connections. All contact surfaces are of copper. A minimum of two plated bolts per splice or connection is required for nonwelded bus except where physical bus size permits only one bolt; the joint shall include an approved means, other than friction, to prevent turning, twisting, or bending. Bolts shall be torqued to the values recommended by the manufacturer.

D. Neutral Bus: Provide bare neutral bus mounted on insulated bus supports. Provide neutral disconnect links to permit isolation of the neutral bus from the common ground bus and service entrance conductors.

E. Ground Bus: Provide an uninsulated 6 mm by 50 mm (1/4 inch by 2 inch) copper equipment ground bus bar the length of the switchgear and secure to each unit frame.

F. Main Bonding Jumper: An uninsulated 6 mm by 50 mm (1/4 inch by 2 inch) copper bus shall interconnect the neutral and ground buses, when the secondary service equipment is incorporated within the switchgear to establish the system common ground point.

2.4 NAMEPLATES AND MIMIC BUS

A. Nameplates: Provide laminated black phenolic resin with white core with 1/2 inch [12mm] engraved lettered nameplates next to each circuit breaker. Nameplates shall indicate equipment served, spaces, or spares in accordance with one line diagram shown on drawings. Nameplates shall be mounted with plated screws on front of breakers or on equipment enclosure next to breakers.

Mounting nameplates only with adhesive is not acceptable.

B. Mimic Bus: Provide mimic bus labeling for the new section and extend to the existing mimic bus labeling. Color shall be black for the Normal Power system. Mimic bus material, appearance, nomenclature, color, etc shall match the existing mimic bus.

2.5 METERING

The new and future feeder breakers shall be provided with a Square D Micrologic Trip Unit, Model 6.0, with integral Power Logic metering.

2.6 SPACE FOR FUTURE

Where "provision for", "future", or "space" is noted on drawings, equip the compartment with rails, mounting brackets, supports, bus connections, and any appurtenances necessary for ready insertion of a future breaker. A blank door shall close off the front of the compartment. Design buses for the breaker ampere rating as indicated on the drawings.

2.7 BREAKER REMOVAL EQUIPMENT

Furnish a permanent top-mounted device for installation and removal of draw-out circuit breakers. The device shall be an overhead breaker lift with rails, ratchet and all hardware for a fully operational removal system.

Extend the rail system from the existing adjacent switchgear section.

2.8 CONTROL WIRING

Switchgear control wiring shall be 600 volt Class B stranded SIS. Install all control wiring complete at the factory, adequately bundled and protected. All conductors size No. 8 and smaller, all conductors across hinges, and all conductors for interconnection between shipping

units shall be Class C stranded. Size conductors in accordance with the NEC. Provide separate control circuit fuses in each breaker compartment and locate for ease of access and maintenance.

2.9 LOW VOLTAGE POWER CIRCUIT BREAKER(S)

- A. General: Circuit breaker(s) shall be 800 Amp frame, dead front, drawout, stored energy type with solid state trip devices. Arcing contacts shall be renewable. Circuit breakers shall be UL listed (Category PAQX) and match existing feeder breakers in design.
- B. Rating: Circuit breakers shall be 3 pole, 600 volts AC and below, 60 cycle with indicated frame size, trip rating and system voltage. Breakers shall have 30 cycle short time current ratings.
- C. Drawout Mounting: Provide a racking mechanism to position and hold the breaker in the connected, test, or disconnected position. Provide an interlock to prevent movement of the breaker into or out of the connected position unless the breaker is tripped open.
- D. Trip Devices: Breakers shall be electrically and mechanically trip free and shall have trip devices in each pole. Unless otherwise indicated, each breaker shall have overcurrent, short-circuit and integral ground fault trip devices. Trip devices shall be of the solid state type with adjustable pick-up settings, with both long time and short time elements, and integral trip unit testing provisions, equal to Square D Micrologic Model 6.0 trip units with integral Power Logic metering. Devices shall have time-delay band adjustment of minimum, intermediate, and maximum setting. Long-time delay element shall have inverse time characteristics. Main circuit breakers shall have short-time trips, in lieu of instantaneous trips. Final settings, of pick-up and time bands shall be as reflected by the Electric System Protective Device Study.
- E. Position Indicator: Provide a mechanical indicator visible from the front of the unit to indicate whether the breaker is open or closed.
- F. Trip Button: Equip each breaker with a mechanical trip button accessible from the front of the door, which shall permit tripping of the breaker.
- G. The new feeder circuit breakers shall be provided with Zone Selective Interlocking to match the existing switchgear configuration.
- H. Padlocking: Provisions shall be included for padlocking the breaker in the open position.

I. Operation: Unless otherwise indicated on the drawings, breakers shall be manually operated.

2.10 SQUARE D STRUXURWARE POWER MONITORING SYSTEM

A. Provide all wiring, hardware and programming to add the new feeder breaker(s) to the existing Square D Struxurware Power Monitoring System.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the switchgear in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.

B. Anchor switchgear to the slab with plated 1/2 inch [12.5mm] minimum anchor bolts, or as recommended by the manufacturer.

C. Interior Location. Mount switchgear on floor slab.

3.2 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. Confirm correct application of manufacturer's recommended lubricants.

d. Verify appropriate anchorage, required area clearances, and correct alignment.

e. Verify that circuit breaker sizes and types correspond to approved shop drawings.

f. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.

g. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

h. Clean switchgear.

i. Inspect insulators for evidence of physical damage or contaminated surfaces.

j. Verify correct shutter installation and operation. k.

Exercise all active components.

l. Verify the correct operation of all sensing devices, alarms, and indicating devices.

m. Verify that vents are clear.

n. Inspect control power transformers.

2. Electrical Tests

a. Perform insulation-resistance tests on each bus section. b.

Perform overpotential tests.

c. Perform insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components. d. Perform phasing check on double-ended switchgear to ensure correct bus phasing from each source.

e. Zone Selective Interlocking operation shall be demonstrated by the use of Primary Injection Testing.

3.3 FOLLOW-UP VERIFICATION

Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the switchgear is in good operating condition and properly performing the intended function. Circuit breakers shall be tripped by operation of each protective device.

3.4 INSTRUCTION

Furnish the services of a factory certified instructor for two 4 hour period for instructing personnel in the operation and maintenance of the switchgear and related equipment on the date requested by the Project Manager.

- - - E N D - - -

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of panelboards.

1.2 RELATED WORK

A. Section 09 91 00, PAINTING: Identification and painting of panelboards. B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.

C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. 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, mounting details, materials, wiring diagrams, accessories, and weights of equipment. 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 and wiring diagrams.
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 Project Manager two weeks prior to final inspection.

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

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): PB-

1-06.....Panelboards

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

C. National Fire Protection Association (NFPA):

70-2005National 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. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings.

B. Panelboards shall be standard manufactured products.

C. All panelboards shall be hinged "door in door" type with:

1. Interior hinged door with hand-operated latch or latches, as required to provide access only to circuit breaker operating handles, not to energized parts.

2. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand-operated latches are not acceptable.
3. Push inner and outer doors shall open left to right.
- D. All panelboards shall be completely factory-assembled with molded case circuit as scheduled on the drawings or specified herein. Include one-piece removable, inner dead front cover, independent of the panelboard cover.
- E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings.
- F. Panelboards shall conform to NEMA PB-1, NEMA AB-1, and UL 67 and have the following features:
 1. Non-reduced size copper bus bars with current ratings as shown on the panel schedules, rigidly supported on molded insulators.
 2. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.
 3. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys of sizes suitable for the conductors to which they will be connected.
 4. Neutral bus shall be 100% rated, mounted on insulated supports.
 5. Grounding bus bar shall be equipped with screws or lugs for the connection of grounding wires.
 6. Buses shall be braced for the available short-circuit current.
Bracing shall not be less than 10,000 A symmetrical for 120/208 V and 120/240 V panelboards, and 14,000 A symmetrical for 277/480 V panelboards.
 7. Branch circuit panelboards shall have buses fabricated for bolt-on type circuit breakers.
 8. Protective devices shall be designed so that they can easily be replaced.
 9. Where designated on panel schedule "spaces," include all necessary bussing, device support, and connections. Provide blank cover for each space.
 10. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main

breaker type panelboards, and have cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.

11. Series-rated panelboards are not permitted.

12. Circuit breakers shall be bolt-in style with a red trip indicator window.

2.2 CABINETS AND TRIMS

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panelboards shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL 50 and UL 67.

2. Cabinet enclosure shall not have ventilating openings.

3. Cabinets for panelboards may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.

4. Panelboard doors shall be hinged door-in-door construction.

2.3 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. 277/480 V Panelboard: 14,000 A symmetrical.

D. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 A frame or lower. Magnetic trip shall be adjustable from 3x to 10x for breakers with 600 A frames and higher. Factory setting shall be HI, unless otherwise noted.

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. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where indicated.
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

2.4 SURGE SUPPRESSION

Where shown on drawings, furnish panelboard with integral transient voltage surge suppression device. Refer to Section 26 43 13, TRANSIENT- VOLTAGE SURGE SUPPRESSION.

2.5 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the circuit breakers are being installed.

2.6 POWER LOGIC METERING

- A. Distribution panels (Panel PMDP) shall be provided with a panel mounted Power Logic Model PM870 meter and software, programming, etc to assure a fully operational system and communication with the existing Power Logic VLAN system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified. B. Locate panelboards so that the present and future conduits can be conveniently connected.
- C. Install a printed schedule of circuits in each panelboard after approval by the Project Manager. Schedules shall be printed on the panelboard directory cards, installed in the appropriate 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. No "stick-on" directories shall be permitted.

D. Mount the fully-aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78 in [1980 mm]. Mount panelboards that are too high such that the bottom of the cabinets will not be less than 6 in [150 mm] above the finished floor.

E. Rust and scale shall be removed from the inside of existing backboxes where new panelboards are to be installed. Paint inside of backboxes with rust-preventive paint before the new panelboard interior is installed. Provide new trim and doors for these panelboards. Covers shall fit tight to the box with no gaps between the cover and the box.

F. Install two (2) $\frac{3}{4}$ " and two (2) 1" spare conduits from each panelboard to ceiling space above the respective panelboard for future use.

G. Panelboards shall be labeled with the panel designation (e.g., Panel C122L), the panel served from, the feeder wire/conduit size and quantity of feeders (e.g. 1 set, 2 sets, etc)

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 panelboards are in good operating condition and properly performing the intended function.

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
09-10

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
09-10

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of wiring devices.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlets boxes.
- C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

1.3 QUALITY ASSURANCE

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

1.4 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, construction materials, grade and termination information.
- C. Manuals: Two weeks prior to final inspection, deliver four copies of the following to the Project Manager: Technical data sheets and information for ordering replacement units.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Project Manager: Certification by the Contractor that the devices comply with the drawings and specifications, and have been properly installed, aligned, 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. National Fire Protection Association (NFPA):

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

National Electrical Manufacturers Association (NEMA):

WD 1.....General Color Requirements for Wiring Devices

WD 6Wiring Devices - Dimensional Requirements

D. Underwriter's Laboratories, Inc. (UL):

5.....Surface Metal Raceways and Fittings

20.....General-Use Snap Switches

231.....Power Outlets

467.....Grounding and Bonding Equipment

498.....Attachment Plugs and Receptacles

943.....Ground-Fault Circuit-Interrupters

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall be listed by Underwriters Laboratories, Inc., and conform to NEMA WD 6.

1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.

2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four min.) and side wiring from four captively held binding screws.

B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD

6. The duplex type shall have break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.

1. Bodies shall be ivory in color for Normal Branch devices and red in color for Critical Branch devices.

2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.

3. Duplex Receptacles on Emergency Circuit:

a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.

4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box. a. Ground fault interrupter shall consist of a differential current

transformer, solid state sensing circuitry and a circuit

interrupter switch. Device shall have nominal sensitivity to ground leakage current of five milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or - 1 milliamp) on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a second.

b. Any receptacle installed exterior or within 6' of a water source such as a faucet, sink, eyewash station, etc shall be GFCI type.

5. Safety Type Duplex Receptacles:

a. Bodies shall be ivory in color.

1) Shall permit current to flow only while a standard plug is in the proper position in the receptacle.

2) Screws exposed while the wall plates are in place shall be the tamperproof type.

b. Devices shall be Hospital Grade

c. Safety type duplex receptacles shall be installed in all Waiting Room areas.

C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete with appropriate cord grip plug. Devices shall meet UL 231.

D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

2.2 TOGGLE SWITCHES

A. Toggle Switches: Shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles shall be ivory for Normal Branch circuits and red for Critical Branch circuits. The rocker type switch is not acceptable and will not be approved.

1. Switches installed in hazardous areas shall be explosion proof type in accordance with the NEC and as shown on the drawings.

2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.

3. Ratings:

a. 120 volt circuits: 20 amperes at 120-277 volts AC. b. 277
volt circuits: 20 amperes at 120-277 volts AC.

2.3 MANUAL DIMMING CONTROL

A. Slide dimmer with on/off control, single-pole or three-way as shown on plans. Faceplates shall be ivory in color unless otherwise specified.

B. Manual dimming controls shall be fully compatible with electronic dimming ballasts/drivers and approved by the ballast/driver manufacturer, shall operate over full specified dimming range, and shall not degrade the performance or rated life of the electronic dimming ballast and lamp.

C. Basis of design for performance and appearance shall be Lutron Nova NTSTV-DV-IV.

D. Dimmers located adjacent each other on a wall shall be ganged together in a common box with a common cover plate. Where the dimmers serve different branches of the electrical system, i.e. Normal and Critical Branches, a barrier partition shall be installed in the common junction box and individual conduits shall serve each dimmer.

2.4 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.

B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD 6.

C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

D. In psychiatric areas, wall plates shall be 302 stainless steel, have tamperproof screws and beveled edges.

E. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.

F. Duplex Receptacles on Emergency Circuit:

1. Bodies shall be red in color. Wall plates shall be red with the word "EMERGENCY" engraved in 6 mm, (1/4 inch) white letters.

2.5 SURFACE MULTIPLE-OUTLET ASSEMBLIES

A. Assemblies shall conform to the requirements of NFPA 70 and UL 5. B. Shall have the following features:

1. Enclosures:

a. Thickness of steel shall be not less than 0.040 inch [1mm] steel for base and cover. Nominal dimension shall be 1-1/2 by 4-3/4 inches with inside cross sectional area not less than 7.1 square

inches. The enclosures shall be thoroughly cleaned, phosphatized and painted at the factory with primer and the manufacturer's standard baked enamel or lacquer finish.

2. Receptacles shall be duplex, hospital grade. See paragraph 'RECEPTACLES' in this section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
3. Unless otherwise shown on drawings, spacing of the receptacles along the strip shall be 24 inches [600mm] on centers.
4. Wires within the assemblies shall be not less than No. 12 AWG copper, with 600 volt ratings.
5. Installation fittings shall be designed for the strips being installed including bends, offsets, device brackets, inside couplings, wire clips, and elbows.
6. Bond the strips to the conduit systems for their branch supply circuits.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC and as shown as on the drawings.
- B. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the green equipment grounding conductor.
- C. Outlet boxes for light and dimmer switches shall be mounted on the strike side of doors.
- D. Provide barriers in multigang outlet boxes to separate systems of different voltages, Normal Power and Emergency Power systems, and in compliance with the NEC.
- E. Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other work. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.
- F. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades. In addition, check for exact direction of

door swings so that local switches are properly located on the strike side.

G. Install wall switches 48 inches [1200mm] above floor, OFF position down. H.

Install wall dimmers 48 inches [1200mm] above floor; derate ganged

dimmers as instructed by manufacturer; do not use common neutral.

I. Install convenience receptacles 18 inches [450mm] above floor, and 6

inches [152mm] above counter backsplash or workbenches.

Receptacles

shall be installed with the ground terminal on top.

Install specific-use

receptacles at heights shown on the drawings.

J. Label wiring device coverplate plates with clear label tape with 12 point

black font identifying the panel and branch circuit serving the device. K.

Test wiring devices for damaged conductors, high circuit resistance,

poor connections, inadequate fault current path, defective devices, or similar

problems using a portable receptacle tester.

Correct circuit

conditions, remove malfunctioning units and replace with new, and retest as

specified above.

L. Test GFCI devices for tripping values specified in UL 1436 and UL 943.

- - - E N D - - -

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. Other sections which specify motor driven equipment, except elevator motor controllers.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 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 Project Manager.

D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certifications to the Project Manager:

1. Certification that the equipment has been properly installed, adjusted, and tested.

2. Certification by the manufacturer that medium voltage motor controller(s) conforms to the requirements of the drawings and specifications. This certification must be furnished to the Project Manager prior to shipping the controller(s) to the job site.

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 (solid state 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 Project Manager, 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. For motor controllers being installed in existing motor control centers or panelboards, coordinate with the existing centers or panelboards.

E. Additional requirements for specific motor controllers, as indicated in other sections, shall also apply.

F. Provide a disconnecting means or safety switch near and within sight of each motor. Provide all wiring and conduit required to facilitate a complete installation.

2.2 MANUAL MOTOR STARTERS

A. Shall be in accordance with applicable requirements of 2.1 above. B. Manual motor starters.

1. Starters shall be general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.

2. Units shall include overload and low voltage protection, red pilot light, two(2) NO/ NC auxiliary contact sets and a toggle operator.

C. Fractional horsepower manual motor starters.

1. Starters shall be general-purpose Class A, manually operated with full voltage controller for fractional horsepower induction motors.

2. Units shall include thermal overload protection, red pilot light and toggle operator.

D. Motor starting switches.

1. Switches shall be general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.

2. Units shall include thermal overload protection, red pilot light low voltage protection, two (2) NO/ NC auxiliary contact sets and a toggle operator.

2.3 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. Minimum size 0.

C. Where combination motor starters are used, combine starter with protective or disconnect device in a common enclosure.

D. Provide phase loss protection for each starter, with contacts to de-energize the starter upon loss of any phase.

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. For motors 75 HP and larger, provide reduced voltage starters.

Equip starters with 120V AC coils and individual control transformer unless otherwise noted. Locate "reset" button to be accessible without opening the enclosure.

2.4 VARIABLE SPEED MOTOR CONTROLLERS

A. Shall be in accordance with applicable portions of 2.1 above.

B. Shall be solid state, micro processor-based with adjustable frequency and voltage, three phase output capable of driving standard NEMA B design, three phase alternating current induction motors at full rated speed. The drives shall utilize a full wave bridge design incorporating diode rectifier circuitry with pulse width modulation (PWM). Other control techniques are not acceptable. Silicon controlled rectifiers (SCR) shall not be used in the rectifying circuitry. The drives shall be designed to be used on variable torque loads and shall be capable of providing sufficient torque to allow the motor to break away from rest upon first application of power.

C. Unit shall be capable of operating within voltage parameters of plus 10 to minus 10 percent of line voltage, and be suitably rated for the full load amps of the maximum watts (HP) within its class.

D. Operating and Design Conditions:

Elevation: 700 feet AMSL

Temperatures: Maximum +90°F Minimum -10°F

Relative Humidity: 95%

Drive Location: Air conditioned Building

E. Controllers shall have the following features:

1. Isolated power for control circuits.
2. Manually re-settable motor overload protection for each phase.
3. Adjustable current limiting circuitry to provide soft motor starting. Maximum starting current shall not exceed 200 percent of motor full load current.
4. Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 30 seconds. (Set timers to the equipment manufacturer's recommended time in the above range.)
5. Provide 4 to 20 ma current follower circuitry for interface with mechanical sensor devices.
6. Automatic frequency adjustment from 20 Hz to 60 Hz.
7. Provide circuitry to initiate an orderly shutdown when any of the conditions listed below occur. The controller shall not be damaged by any of these electrical disturbances and shall automatically restart when the conditions are corrected. The drive shall be able to restart into a rotating motor operating in either the forward or reverse direction and matching that frequency.
 - a. Incorrect phase sequence.
 - b. Single phasing.
 - c. Over voltage in excess of 10 percent.
 - d. Under voltage in excess of 10 percent.
 - e. Running over current above 110 percent (shall not automatically reset for this condition.)
 - f. Instantaneous overcurrent above 150 percent (shall not automatically reset for this condition).
 - g. Surge voltage in excess of 1000 volts.
 - h. Short duration power outages of 12 cycles or less (i.e., distribution line switching, generator testing, and automatic transfer switch operations.)
8. Provide automatic shutdown on receipt of a power transfer warning signal from an automatic transfer switch. Controller shall automatically restart motor after the power transfer.
9. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for

manual reset or fault correction; adjustable delay time between restart attempts.

10. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

11. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

F. Minimum efficiency shall be 95 percent at 100 percent speed and 85percent at 50 percent speed.

G. The displacement power factor of the controller shall not be less than 95 percent under any speed or load condition.

H. Controllers shall include a door interlocked fused safety disconnect switch or door interlocked circuit breaker switch which will disconnect all input power.

I. Controller shall include a 3% line reactor, and RFI/EMI filter.

J. The following accessories are to be door mounted:

1. AC Power on light.

2. Ammeter (RMS motor current).

3. HAND-OFF-AUTOMATIC switch.

4. Manual speed control in HAND mode.

5. System protection lights indicating that the system has shutdown and will not automatically restart.

6. System protection light indicating that the system has shutdown but will restart when conditions return to normal.

7. Manual variable speed controller by-pass switch.

8. Diagnostic shutdown indicator lights for each shutdown condition.

9. Provide two N.O. and two N.C. dry contacts rated 120 volts, 10 amperes, 60 HZ for remote indication of the following:

a. System shutdown with auto restart.

b. System shutdown without auto restart. c. System running.

10. Incorporate into each control circuit a 120-volt, time delay relay (ON delay), adjustable from 0.3-10 minutes, with transient protection. Provide transformer(s) for the control circuit(s).

11. Controller shall not add any current or voltage transients to the input AC power distribution system nor shall transients from other devices on the AC power distribution system affect the controller. Controllers shall be protected to comply with IEEE C37.90.1 and

UL-508. Line noise and harmonic voltage distortion shall not exceed the values allowed by IEEE 519.

K. Hardware and software to enable the BAS to monitor, control, and display controller status and alarms.

L. Network Communications Ports: Ethernet and RS-422/485.

M. Embedded BAS Protocols for Network Communications: As specified in Division 22.

N. Bypass Operation: Manually transfers motor between power converter output and bypass circuit, manually, automatically, or both. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.

O. Bypass Controller: Provide contactor-style bypass, arranged to isolate the power converter input and output and permit safe testing of the power converter, both energized and de-energized, while motor is operating in bypass mode. Motor overload protection shall be provided.

1. Bypass Contactor: Load-break NEMA-rated contactor.

2. Input and Output Isolating Contactors: Non-load-break, NEMA-rated contactors.

3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

2.5 MOTOR CONTROL STATIONS

A. Shall have the following features:

1. Designed for suitably fulfilling the specific control functions for which each station is being installed.

2. Coordinate the use of momentary contacts and maintained contacts with the complete motor control systems to insure safety for people and equipment.

3. Each station shall have two pilot lights behind red and green jewels and a circuit to its motor controller. Connect the lamps so they will be energized as follows:

a. Red while the motor is running.

b. Green while the motor is stopped.

4. Where two or more stations are mounted adjacent to each other, install a common wall plate, except where the designs of the stations make such common plates impracticable.

5. Identify each station with a permanently attached individual nameplate, of laminated black phenolic resin with a white core and engraved lettering not less than 6 mm (1/4-inch) high. Identify the motor by its number or other designation and indicate the function fulfilled by the motor.

B. Components of Motor Control Circuits:

1. Shall also be designed and arranged so that accidental faulting or grounding of the control conductors will not be able to start the motors.
2. Use of locking type STOP pushbuttons or switches, which cause motors to restart automatically when the pushbuttons or switches are released, will not be permitted.

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.
- E. Install manual motor starters in flush enclosures in finished areas.
- F. Examine control diagrams indicated before ordering motor controllers. Should conflicting data exist in specifications, drawings and diagrams, request corrected data prior to placing orders.

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 Project Manager 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 and variable speed motor controllers. 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.

2. Variable speed motor controllers:

a. Final programming and connections to variable speed motor controllers shall be by a factory-trained technician. Set all programmable functions of the variable speed motor controllers to meet the requirements and conditions of use.

b. Test all control and safety features of the variable frequency drive.

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 and variable speed motor controllers 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.

- - - E N D - - -

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 rated toggle switches.

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 Project Manager 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 Project Manager:

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 and NEMA classification Heavy Duty (HD) for 480 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.

2.3 MOTOR RATED TOGGLE SWITCHES

Refer to Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

2.4 LOW VOLTAGE CARTRIDGE FUSES

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

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.

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 Project Manager.

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
9-10

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 41 00
FACILITY LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the extension of the existing system and furnishing/installation of a complete master labeled lightning protection system, complying with NFPA 780, UL 96 and UL 96A.

1.2 RELATED WORK

- A. Section 07 60 00, FLASHING AND SHEET METAL: penetrations through the roof.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements 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 to ground for possible ground faults.

1.3 QUALITY ASSURANCE

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

1.4 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
 - B. Shop Drawings:
 - 1. Isometric and plan views showing layout and connections to the required metal surfaces.
 - 2. Show the methods of mounting the system to the adjacent construction.
 - C. Qualifications: Submit proof that the installer of the lightning protection system is a certified Lightning Protection Institute (LPI) installer, and has had suitable and adequate experience installing other lightning protection systems, and is capable of installing the system as recommended by the manufacturer of the equipment.
- D. Certification: Two weeks prior to final inspection, submit four copies of the following certifications to the Project Manager:
 - 1. Certification that the lightning protection system has been properly installed and tested.
 - 2. Certification that the lightning protection system has been inspected by a UL representative and has been approved by UL without variation.

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 Fire Protection Association (NFPA):

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

780.....Standard for the Installation of Lightning
Protection Systems

C. Underwriters Laboratories, Inc. (UL):

96.....Lightning Protection Components

96A.....Installation Requirements for Lightning
Protection Systems

UL 467Standard for Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 MATERIALS

A. Attach master labels to each item by its manufacturer as evidence that the materials have been manufactured in conformance with the UL Standards for master label lightning protection materials.

B. In addition to conformance to UL 96, the component material requirements are as follows:

1. Conductors: Electrical grade copper. Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2. Air terminals: Solid copper, 18 inches long, not less than 3/8 inch [9mm] diameter, with sharp nickel-plated points.

3. Ground rods: Copper clad steel, steel, solid copper, not less than 1/2 inch [13mm] diameter by 8 feet [2400mm] long. Rods made of copper-clad steel shall conform to UL 467 and galvanized ferrous rods shall conform to IEEE C135.30. Ground rods of copper-clad steel, steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the project.

C. Anchors and fasteners: Bolt type which are most suitable for the specific anchor and fastener installations. Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation. Clamp-type connectors shall only be used for the connection of the roof conductor to the air terminal and to the guttering. All other connections, bonds, and splices shall be done by exothermic welds or by high compression fittings. The exothermic welds and high compression fittings shall be listed for the purpose. The high compression fittings shall be the type

which require a hydraulically operated mechanism to apply a minimum of 10,000 psi.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be coordinated with the roofing manufacturer and installer.
- B. Install the conductors as inconspicuously as practical and with the proper bends.
- C. Install the vertical conductors within the concealed cavity of exterior walls. Run the conductors to the exterior at elevations below the finished grade and make the ground connections to the earth outside of the building or stack perimeter.
- D. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.
- E. Use the exothermic welding type connections that form solid metal joints in the main vertical and horizontal conductors, and for connections that are not exposed in the finish work.
- F. Protect copper conductors with stiff copper or brass tubing, which enclose the conductors from the top to the bottom of the tubing, between one foot [300mm] below and seven feet [2100mm] above the finished grade. The conductor shall be bonded to the top and bottom of the tubing.
- G. Sheath copper conductors, which pass over cast stone, cut stone, architectural concrete and masonry surfaces, with not less than a 1/16 inch [2mm] thickness of lead to prevent staining of the exterior finish surfaces.
- H. For the earth connections, install ground rods and ground plates, and the conductor connections to them and the main water pipes in the presence of the Project Manager. For the conductors located outside of the building or stack, install the conductors not less than two feet [600mm] below the finished grade.
- I. Connect lightning protection cables to all metallic projections, equipment, and components above the roof as indicated on the drawings.
- J. Connect exterior metal surfaces, located within three feet [900mm] of the lightning protection system conductors, to the lightning protection system conductors to prevent flashovers.
- K. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least an 8-inch radius and do not exceed 90 degrees.
- L. Conductors shall be rigidly fastened every three feet [900mm] along the roof and down to the building to ground.

M. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Install air terminal bases, cable holders and other roof- system supporting means without piercing roof metal.

N. Use through-roof connectors for down-conductor attachment to roof system. Provide flashing in accordance with Section 07 60 00, FLASHING AND SHEET METAL.

O. Down-conductors coursed on or in reinforced concrete columns or on structural steel columns shall be connected to the reinforcing steel or the structural steel member at its upper and lower extremities. In the case of long vertical members an additional connection shall be made at intervals not exceeding 100 feet [30m].

P. A counterpoise, where shown, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet [600mm] deep at a distance not less than 3 feet [900mm] nor more than 8 feet [2.5m] from the nearest point of the structure.

Q. On construction utilizing post tensioning systems to secure precast concrete sections, the post tension rods shall not be used as a path for lightning to ground. Down conductors shall be provided on structures using post tensioning systems. Down conductors shall have sufficient separation from post tension rods to prevent side-flashing. Post tension rods shall be bonded to the lightning protection and grounding systems only at the base of the structure; this bonding shall be performed in strict accordance with the recommendations of the post tension rod manufacturer, and shall be done by, or in the presence of, a representative of the manufacturer.

R. Grounding: Test the ground resistance to earth by standard methods and conform to the ground resistance requirements specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

S. Where shown, use the structural steel framework or reinforcing steel as the main conductor:

1. Weld or bond the non-electrically-continuous sections together and make them electrically continuous.
2. Verify the electrical continuity by measuring the ground resistances to earth at the ground level, at the top of the building or stack, and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.

3. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 60 foot [18m] intervals.
 4. Install ground connections to earth at not more than 60 foot [18m] intervals around the perimeter of the building.
 5. Weld or braze bonding plates, not less than 8 inches [200mm] square, to cleaned sections of the steel and connect the conductors to the plates.
 6. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to UL Publication No. 96A.
- T. When the lightning protection systems have been installed, have the systems inspected by a UL representative. Obtain and install a UL numbered master label for each of the lightning protection systems at the location directed by the UL representative and the Project Manager.
- U. Where the documents show the new lightning protection system connected to an existing lightning protection system without a UL master label, the new portion of the lightning system still requires inspection and labels as specified above for new work.

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
4-09

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 26 51 00
INTERIOR LIGHTING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the furnishing, installation and connection of the interior lighting systems.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.

B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

D. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

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

1.4 SUBMITTALS

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

B. Product Data: For each type of lighting fixture (luminaire) designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of fixture designation, submit the following information.

1. Material and construction details include information on housing, optics system and lens/diffuser.

2. Physical dimensions and description.

3. Wiring schematic and connection diagram.

4. Installation details.

5. Energy efficiency data.

6. Photometric data based on laboratory tests complying with IESNA Lighting Measurements, testing and calculation guides.

7. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours) and color temperature (degrees Kelvin).

8. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts and total harmonic distortion (THD).

C. Manuals:

1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the Project Manager.

D. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following certifications to the Project Manager:
 - a. Certification by the Contractor 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 designation only.

B. Institute of Electrical and Electronic Engineers (IEEE):

C62.41-91.....Guide on the Surge Environment in Low Voltage
(1000V and less) AC Power Circuits

C. National Fire Protection Association (NFPA):

70.....National Electrical Code (NEC)
101.....Life Safety Code

D. National Electrical Manufacturer's Association (NEMA):

C82.1-97.....Ballasts for Fluorescent Lamps - Specifications
C82.2-02.....Method of Measurement of Fluorescent Lamp
Ballasts

C82.4-02.....Ballasts for High-Intensity-Discharge and Low-
Pressure Sodium Lamps

C82.11-02.....High Frequency Fluorescent Lamp Ballasts

E. Underwriters Laboratories, Inc. (UL):

496-96.....Edison-Base Lampholders
542-99.....Lampholders, Starters, and Starter Holders for
Fluorescent Lamps

844-95.....Electric Lighting Fixtures for Use in Hazardous
(Classified) Locations

924-95.....Emergency Lighting and Power Equipment

935-01.....Fluorescent-Lamp Ballasts

1029-94.....High-Intensity-Discharge Lamp Ballasts

1029A-06.....Ignitors and Related Auxiliaries for HID Lamp
Ballasts

1598-00.....Luminaires
1574-04.....Standard for Track Lighting Systems
2108-04.....Standard for Low-Voltage Lighting Systems
8750-08.....Light Emitting Diode (LED) Light Sources for Use in
Lighting Products

F. Federal Communications Commission (FCC):

Code of Federal Regulations (CFR), Title 47, Part 18

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES (LUMINAIRES)

A. Shall be in accordance with NFPA 70 and UL 1598, as shown on drawings, and as specified.

B. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.

2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.

3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.

4. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, latches shall function easily by finger action without the use of tools.

C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

D. Lamp Sockets:

1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Lamp holders for bi-pin lamps shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.

2. High Intensity Discharge (H.I.D.): Shall have porcelain enclosures. E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive

screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

G. Metal Finishes:

1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner

to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.

2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.

3. Exterior finishes shall be as shown on the drawings.

H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

I. Light Transmitting Components for Fluorescent Fixtures:

1. Shall be 100 percent virgin acrylic.

2. Flat lens panels shall have not less than 1/8 inch [3.2mm] of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.

3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.

J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Group areas as defined in NFPA 70, and shall comply with UL 844.

K. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures (not the lamp). Fixtures shall be designed for lamps as specified.

L. Type FR pendant fixtures shall be provided with Lutron Ecosystem Series H ballasts. Each space served by these fixtures shall also be provided with a Lutron RMJ ECO 32 PowPak dimming module(s) and Lutron LRF2 Daylight sensors (quantity as required for complete daylighting control) and a recessed Lutron PJ2 Pico control station with CW-1 wall plate. The location of each Pico control station shall be confirmed

with the Architect prior to installation. Provide all control wiring, power connections, programming and manufacturer's representative setup/commissioning for a fully operational daylighting system.

2.2 BALLASTS

A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V) electronic programmed-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:

1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: 10 percent or less.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. Ballast Factor: 0.87 or higher unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Interference: Comply with 47 CFT 18, Ch.1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
11. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
12. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.
13. Dimming ballasts shall be as per above, except dimmable from 100% to 10% of rated lamp lumens.
14. Fluorescent ballasts installed in stairwell lighting fixtures controlled by occupancy sensors shall be step-dim type.

B. Compact Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V), electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: 10 percent or less.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. Ballast Factor: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

2.3 LAMPS

A. Linear T5 and T8 Fluorescent Lamps:

1. Rapid start fluorescent lamps shall comply with ANSI C78.1; and instant-start lamps shall comply with ANSI C78.3.
2. Chromacity of fluorescent lamps shall comply with ANSI C78.376.
3. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature of 4100°K, a Color Rendering Index (CRI) of greater than 70, average rated life of 20,000 hours, and be suitable for use with dimming ballasts, unless otherwise indicated. Low mercury lamps shall have passed the EPA Toxicity Characteristic Leachate Procedure (TCLP) for mercury by using the lamp sample preparation procedure described in NEMA LL 1.

2.4 EXIT LIGHT FIXTURES

A. Exit light fixtures shall meet applicable requirements of NFPA 101 and UL 924.

B. Housing and Canopy:

1. Shall be made of white plastic.

C. There shall be no radioactive material used in the fixtures. D.

Fixtures:

1. Maximum fixture wattage shall be 1 watt or less.

2. Inscription panels stenciled with 6 inch [150mm] high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass. The LED shall be rated minimum 25 years life.

3. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.

4. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

E. Voltages: Refer to Lighting Fixture Schedule.

2.5 LED LIGHT FIXTURES

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.

2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.

3. LED drivers shall include the following features unless otherwise indicated:

a. Minimum efficiency: 85% at full load.

b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)

c. Input Voltage: 120 - 277V (±10%) at 60 Hz.

d. Integral short circuit, open circuit, and overload protection. e. Power Factor: ≥ 0.95.

f. Total Harmonic Distortion: ≤ 20%.

g. Comply with FCC 47 CFR Part 15.

4. LED modules shall include the following features unless otherwise indicated:

a. Comply with IES LM-79 and LM-80 requirements.

b. Minimum CRI 80 and color temperature 4000° K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.

c. Minimum Rated Life: 50,000 hours per IES L70.

d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE. B. LED Troffers and signage:

1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

2. Housing, LED driver, and LED module shall be products of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.
- B. Align, mount and level the lighting fixtures uniformly.
- C. Fluorescent bed light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable.
- D. Lighting Fixture Supports:
 - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 - 2. Shall maintain the fixture positions after cleaning and relamping.
 - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 - 4. Hardware for recessed fluorescent fixtures:
 - a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
 - b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.
 - 5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
 - a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch [6mm] secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
 - b. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4 inch [6mm] studs or threaded plaster inserts secured to ceiling

structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4 inch [6mm] toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

c. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

6. Surface mounted lighting fixtures:

a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 1/4-20 [6mm] bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 56 pounds [25kg] shall be supported directly from the building structure.

b. Where ceiling cross runners are installed for support of lighting fixtures they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

c. Fixtures less than 15 pounds [6.8kg] in weight and occupying less than two square feet [600mm x 600mm] of ceiling area may, (when designed for the purpose) be supported directly from the outlet box when all the following conditions are met.

1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.

2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.

3) The outlet box is supported vertically from the building structure.

d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.

7. Single or double pendant-mounted lighting fixtures:

a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.

8. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

E. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.

F. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

G. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

H. Exercise electronic dimming ballasts over full range of dimming capability by operating the control devices(s) in the presence of the Project Manager. Observe for visually detectable flicker over full dimming range.

I. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless a lesser period is specifically recommended by lamp manufacturer. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage. Replace any lamps and ballasts which fail during burn-in.

J. At completion of project, relamp/reballast fixtures which have failed lamps/ballasts. Clean fixtures, lenses, diffusers and louvers that have accumulated dust/dirt/fingerprints during construction. Replace damaged lenses, diffusers and louvers with new.

K. All existing lighting fixtures indicated to be reused shall be cleaned and lamped with new lamps prior to reinstallation.

L. Dispose of lamps per requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

- - - E N D - - -

Division 27

Communications

Division **27**

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 27 05 11
REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section, Requirements for Communications Installations, applies to all sections of Division 27.

B. Furnish and install communications cabling, systems, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of transformers, cable, and other items and arrangements for the specified items are shown on drawings.

1.2 MINIMUM REQUIREMENTS

A. References to industry and trade association standards and codes are minimum installation requirement standards.

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

1.3 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.4 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Project Manager a minimum of 15 working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the Project Manager prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.5 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.6 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
2. Damaged equipment shall be, as determined by the Project Manager, placed in first class operating condition or be returned to the source of supply for repair or replacement.

3. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.7 WORK PERFORMANCE

A. Job site safety and worker safety is the responsibility of the contractor.

B. For work on existing stations, arrange, phase and perform work to assure communications service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

D. Coordinate location of equipment and pathways with other trades to minimize interferences. See the GENERAL CONDITIONS.

1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.

2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.9 EQUIPMENT IDENTIFICATION

A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4 inch) high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.10 SUBMITTALS

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

B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage, or installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings, and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements.

Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole.

Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION _____".

2. Submittals shall be marked to show specification reference including the section and paragraph numbers.

3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements.

Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.

2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.

3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.

2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
 - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
 - b. A control sequence describing start-up, operation, and shutdown.
 - c. Description of the function of each principal item of equipment.
 - d. Installation and maintenance instructions.
 - e. Safety precautions.
 - f. Diagrams and illustrations.
 - g. Testing methods.
 - h. Performance data.
 - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
 - j. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
- G. Approvals will be based on complete submission of manuals together with shop drawings.
- H. After approval and prior to installation, furnish the Project Manager with one sample of each of the following:
 1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
 2. Each type of conduit and pathway coupling, bushing and termination fitting.
 3. Raceway and pathway hangers, clamps and supports.
 4. Duct sealing compound.
- I. In addition to the requirement of SUBMITTALS, the VA reserves the right to request the manufacturer to arrange for a VA representative to see

typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.

1.11 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.12 TRAINING

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

B. Training shall be provided for the particular equipment or system as required in each associated specification.

C. A training schedule shall be developed and submitted by the contractor and approved by the Project Manager at least 30 days prior to the planned training.

- - - E N D - - -

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies general grounding and bonding requirements of telecommunication installations for equipment operations.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, telecommunications 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 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 27.
- B. Section 27 10 00, STRUCTURED CABLING: Low Voltage power and lighting wiring.
- C. Section 26 41 00, FACILITY LIGHTNING PROTECTION: Requirements for a lightning protection system.

1.3 SUBMITTALS

- A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- B. Shop Drawings:
1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Project Manager:
1. Certification that the materials and installation is in accordance with the drawings and specifications.
 2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

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

B1-2001.....Standard Specification for Hard-Drawn Copper
Wire

B8-2004.....Standard Specification for Concentric-Lay- Stranded
Copper Conductors, Hard, Medium-Hard, or Soft

B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-1983.....IEEE Guide for Measuring Earth Resistivity, Ground
Impedance, and Earth Surface Potentials of a Ground System

C. National Fire Protection Association (NFPA):

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

Telecommunications Industry Association, (TIA)

J-STO-607-A-2002.....Commercial Building Grounding (Earthing) and
Bonding Requirements for Telecommunications

E. Underwriters Laboratories, Inc. (UL):

44-2005Thermoset-Insulated Wires and Cables

83-2003Thermoplastic-Insulated Wires and Cables

467-2004Grounding and Bonding Equipment

486A-486B-2003Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm² (4 AWG) and larger shall be permitted to be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

C. Isolated Power System: Type XHHW-2 insulation with a dielectric constant of 3.5 or less.

D. Telecom System Grounding Riser Conductor: Telecommunications Grounding Riser shall be in accordance with J STO-607A. Use a minimum 50mm² (1/0 AWG) insulated stranded copper grounding conductor unless indicated otherwise.

2.2 SPLICES AND TERMINATION COMPONENTS

Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.3 TELECOMMUNICATION SYSTEM GROUND BUSBARS

A. Provide solid copper busbar, pre-drilled from two-hole lug connections with a minimum thickness of 6 mm (1/4 inch) for wall and backboard mounting using standard insulators sized as follows:

1. Room Signal Grounding: 300 mm x 100 mm (12 inches x 4 inch).
2. Master Signal Ground: 600 mm x 100 mm (24 inches x 4 inch).

2.4 GROUND CONNECTIONS

A. Below Grade: Exothermic-welded type connectors. B.

Above Grade:

1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.
 2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
 3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.
- C. Cable Shields: Make ground connections to multipair communications cables with metallic shields using shield bonding connectors with screw stud connection.

2.5 EQUIPMENT RACK AND CABINET GROUND BARS

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x 3/4 inch).

2.6 GROUND TERMINAL BLOCKS

At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.7 SPLICE CASE GROUND ACCESSORIES

Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm² (6 AWG) insulated ground wire with shield bonding connectors.

PART 3 - EXECUTION

3.1 GENERAL

A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
3. Isolation transformers and isolated power systems shall not be system grounded.

C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 SECONDARY EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
2. Provide a supplemental ground electrode and bond to the grounding electrode system.

C. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or

building-mounted service entrance equipment need not contain an equipment grounding conductor.

3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

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

E. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).

2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

F. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

3.4 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.

3.5 TELECOMMUNICATIONS SYSTEM

A. Bond telecommunications system grounding equipment to the electrical grounding electrode system.

B. Furnish and install all wire and hardware required to properly ground, bond and connect communications raceway, cable tray, metallic cable shields, and equipment to a ground source.

C. Ground bonding jumpers shall be continuous with no splices. Use the shortest length of bonding jumper possible.

D. Provide ground paths that are permanent and continuous with a resistance of 1 ohm or less from raceway, cable tray, and equipment connections to the building grounding electrode. The resistance across individual bonding connections shall be 10 milli ohms or less.

E. Above-Grade Grounding Connections: When making bolted or screwed connections to attach bonding jumpers, remove paint to expose the

entire contact surface by grinding where necessary; thoroughly clean all connector, plate and other contact surfaces; and apply an appropriate corrosion inhibitor to all surfaces before joining.

F. Bonding Jumpers:

1. Use insulated ground wire of the size and type shown on the Drawings or use a minimum of 16 mm² (6 AWG) insulated copper wire.
2. Assemble bonding jumpers using insulated ground wire terminated with compression connectors.
3. Use compression connectors of proper size for conductors specified. Use connector manufacturer's compression tool.

G. Bonding Jumper Fasteners:

1. Conduit: Fasten bonding jumpers using screw lugs on grounding bushings or conduit strut clamps, or the clamp pads on push-type conduit fasteners. When screw lug connection to a conduit strut clamp is not possible, fasten the plain end of a bonding jumper wire by slipping the plain end under the conduit strut clamp pad; tighten the clamp screw firmly. Where appropriate, use zinc-plated external tooth lockwashers.
2. Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers, and nuts. Install protective cover, e.g., zinc-plated acorn nuts on any bolts extending into wireway or cable tray to prevent cable damage.
3. Ground Plates and Busbars: Fasten bonding jumpers using two-hole compression lugs. Use tin-plated copper or copper alloy bolts, external tooth lockwashers, and nuts.
4. Unistrut and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and external tooth lockwashers.

3.6 COMMUNICATION ROOM GROUNDING

A. Telecommunications Ground Busbars:

1. Provide communications room telecommunications ground busbar hardware at 950 mm (18 inches) at locations indicated on the Drawings.
2. Connect the telecommunications room ground busbars to other room grounding busbars as indicated on the Grounding Riser diagram.

B. Telephone-Type Cable Rack Systems: aluminum pan installed on telephone-type cable rack serves as the primary ground conductor within the

communications room. Make ground connections by installing the following bonding jumpers:

1. Install a 16 mm² (6 AWG) bonding between the telecommunications ground busbar and the nearest access to the aluminum pan installed on the cable rack.

2. Use 16 mm² (6 AWG) bonding jumpers across aluminum pan junctions. C. Self-Supporting and Cabinet-Mounted Equipment Rack Ground Bars:

1. When ground bars are provided at the rear of lineup of bolted together equipment racks, bond the copper ground bars together using solid copper splice plates supplied by the ground bar manufacturer.

2. Bond together nonadjacent ground bars on equipment racks and cabinets with 16 mm² (6 AWG) insulated copper wire bonding jumpers attached at each end with compression-type connectors and mounting bolts.

3. Provide a 16 mm² (6 AWG) bonding jumper between the rack and/or cabinet ground busbar and the aluminum pan of an overhead cable tray or the raised floor stringer as appropriate.

D. Backboards: Provide a screw lug-type terminal block or drilled and tapped copper strip near the top of backboards used for communications cross-connect systems. Connect backboard ground terminals to the aluminum pan in the telephone-type cable tray using an insulated 16 mm² (16 AWG) bonding jumper.

E. Other Communication Room Ground Systems: Ground all metallic conduit, wireways, and other metallic equipment located away from equipment racks or cabinets to the cable tray pan or the telecommunications ground busbar, whichever is closer, using insulated 16 mm² (6 AWG) ground wire bonding jumpers.

3.7 COMMUNICATIONS CABLE GROUNDING

A. Bond all metallic cable sheaths in multipair communications cables together at each splicing and/or terminating location to provide 100 percent metallic sheath continuity throughout the communications distribution system.

1. At terminal points, install a cable shield bonding connector provide a screw stud connection for ground wire. Use a bonding jumper to connect the cable shield connector to an appropriate ground source like the rack or cabinet ground bar.

2. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or the splice case grounding and bonding accessories provided by the splice case manufacturer. When an external ground connection is provided as part of splice closure, connect to an approved ground source and all other metallic components and equipment at that location.

3.8 COMMUNICATIONS CABLE TRAY SYSTEMS:

A. Bond the metallic structures of one cable tray in each tray run following the same path to provide 100 percent electrical continuity throughout these cable tray systems as follows:

1. Splice plates provided by the cable tray manufacturer can be used for providing a ground bonding connection between cable tray sections when the resistance across a bolted connection is 10 milliohms or less. The Subcontractor shall verify this loss by testing across one splice plate connection in the presence of the Contractor.
2. Install a 16 mm² (6 AWG) bonding jumper across each cable tray splice or junction where splice plates cannot be used.
3. When cable tray terminations to cable rack, install 16 mm² (6 AWG) bonding jumper between cable tray and cable rack pan.

3.9 COMMUNICATIONS RACEWAY GROUNDING

- A. Conduit: Use insulated 16 mm² (6 AWG) bonding jumpers to ground metallic conduit at each end and to bond at all intermediate metallic enclosures.
- B. Wireway: use insulated 16 mm² (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and across all section junctions.
- C. Cable Tray Systems: Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 16 meters (50 feet).

3.10 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Government. Final tests shall assure that this requirement is met.

- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground

resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Services at power company interface points shall comply with the power company ground resistance requirements.

D. Below-grade connections shall be visually inspected by the Project Manager prior to backfilling. The Contractor shall notify the Project Manager 24 hours before the connections are ready for inspection.

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
10-06M

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 27 05 33
RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for all communications cabling unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Mounting board for communication closets: Section 06 10 00, ROUGH CARPENTRY.

B. Sealing around penetrations to maintain the integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.

C. Fabrications for the deflection of water away from the building envelope at penetrations: Section 07 60 00, FLASHING AND SHEET METAL.

D. Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 07 92 00, JOINT SEALANTS.

E. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

F. General electrical requirements and items that is common to more than one section of Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

G. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

A. Shop Drawings:

1. Size and location of panels and pull boxes
2. Layout of required conduit penetrations through structural elements.
3. The specific item proposed and its area of application shall be identified on the catalog cuts.

B. Certification: Prior to final inspection, deliver to the Project Manager four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. National Fire Protection Association (NFPA):

70-05.....National Electrical Code (NEC) C.

Underwriters Laboratories, Inc. (UL):

1-03.....Flexible Metal Conduit

5-01.....Surface Metal Raceway and Fittings

6-03.....Rigid Metal Conduit

50-03.....Enclosures for Electrical Equipment

360-03.....Liquid-Tight Flexible Steel Conduit

467-01.....Grounding and Bonding Equipment

514A-01.....Metallic Outlet Boxes

514B-02.....Fittings for Cable and Conduit

514C-05.....Nonmetallic Outlet Boxes, Flush-Device Boxes and
Covers

651-02.....Schedule 40 and 80 Rigid PVC Conduit

651A-03.....Type EB and A Rigid PVC Conduit and HDPE Conduit

797-03.....Electrical Metallic Tubing

1242-00.....Intermediate Metal Conduit

D. National Electrical Manufacturers Association (NEMA):

TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and
Tubing

FB1-03.....Fittings, Cast Metal Boxes and Conduit Bodies for
Conduit, Electrical Metallic Tubing and
Cable

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 19 mm (3/4 inch) unless otherwise shown. B.

Conduit:

1. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.

2. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.

3. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.

4. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3.

Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.

5. Flexible galvanized steel conduit: Shall Conform to UL 1.

6. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

7. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

8. Surface metal raceway: Shall Conform to UL 5. C.

Conduit Fittings:

1. Rigid steel and IMC conduit fittings:

a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.

a. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.

b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.

e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2. Rigid aluminum conduit fittings:

a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.

b. Locknuts and bushings: As specified for rigid steel and IMC conduit.

c. Set screw fittings: Not permitted for use with aluminum conduit.

3. Electrical metallic tubing fittings:

- a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
- b. Only steel or malleable iron materials are acceptable.
- c. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
- d. Indent type connectors or couplings are prohibited.
- e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

4. Flexible steel conduit fittings:

- a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
- b. Clamp type, with insulated throat.

5. Liquid-tight flexible metal conduit fittings:

- a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
- b. Only steel or malleable iron materials are acceptable.
- c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

6. Direct burial plastic conduit fittings:

- a. Fittings shall meet the requirements of UL 514C and NEMA TC3.
- b. As recommended by the conduit manufacturer.

7. Surface metal raceway fittings: As recommended by the raceway manufacturer.

8. Expansion and deflection couplings:

- a. Conform to UL 467 and UL 514B.
- b. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
- c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.

d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:

1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:

1. UL-50 and UL-514A.
 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
 4. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.
- F. Wireways: Equip with hinged covers, except where removable covers are shown.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Project Manager prior to drilling through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Project Manager as required by limited working space.

B. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00,

FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

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. Install conduit as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically continuous.
6. Independently support conduit at 8'0" on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
12. Do not use aluminum conduits in wet locations.
13. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

B. Conduit Bends:

1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

C. Layout and Homeruns:

1. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the Project Manager.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.

2. Align and run conduit in direct lines.

3. Install conduit through concrete beams only when the following occurs:

a. Where shown on the structural drawings.

b. As approved by the Project Manager prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.

a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.

b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings. c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits. 5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors 600 volts and below:

a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.

2. Align and run conduit parallel or perpendicular to the building lines.

3. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (six feet) of flexible metal conduit extending from a junction box to the fixture.

4. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
 - B. Conduit for conductors above 600 volts:
 - 1. Rigid steel or rigid aluminum.
 - 2. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
 - C. Conduit for Conductors 600 volts and below:
 - 1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
 - D. Align and run conduit parallel or perpendicular to the building lines. E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
 - F. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.
 - G. Surface metal raceways: Use only where shown. H.
- Painting:
- 1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
 - 2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 EXPANSION JOINTS

- A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 75 mm (3 inches) and larger conduits are acceptable.
- C. Install expansion and deflection couplings where shown.

3.6 CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
 - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2. Existing Construction:
 - a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
 - b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable. H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.7 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - 1. Flush mounted.

2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

3.8 COMMUNICATION SYSTEM CONDUIT

A. Install the communication raceway system as shown on drawings.

B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

H. All empty conduits located in communication closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

J. Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in Section 06 10 00, ROUGH CARPENTRY on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.

K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
12-05M

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 27 41 31
MASTER ANTENNA TELEVISION EQUIPMENT AND SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

A. Work covered by this document includes design, engineering, labor, material, products, guarantee, training and services for, and incidental to the complete extension of the existing Master Antenna Television (TV) equipment and systems as detailed herein.

B. Work shall be complete, complete, labeled and certified and ready for operation

1.2 RELATED SECTIONS

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 Volts and Below).

C. Section 26 41 00, FACILITY LIGHTNING PROTECTION.

D. Section 27 10 00, STRUCTURED COMMUNICATIONS SYSTEMS CABLING.

E. Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

F. Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

G. Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

1.3 DEFINITIONS

A. Provide: Design, engineer, furnish, install, connect complete, test, certify and guarantee.

B. Work: Materials furnished and completely installed.

C. Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.

1.4 REFERENCES

A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:

1. United States Federal Law/Codes:

a. Departments of: a. CFR,
Title 15 b. CFR, Title 29,

- c. Public Law No. 100-527, Department of Veterans Affairs:
- d. Title 42, CFC, Department of Health, Chapter IV Health and Human Services, Subpart 1395(a) (b) Joint Commission on Accreditation of Healthcare Organizations (JCAHO) "a hospital that meets JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:" All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.
2. National Codes:
- a. American Institute of Architects (AIA): Guidelines for Healthcare Facilities.
- b. American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA
- c. Institute of Electrical and Electronics Engineers (IEEE). d. NFPA:

70	National Electrical Code (current date of issue) - Articles 517, 645 and 800.
99	Healthcare Facilities.
101	Life Safety Code.

1.5 QUALIFICATIONS

- A. The OEM shall have had experience with three or more installations of systems of comparable size and complexity about type and design as specified herein. Each of these installations shall have performed satisfactorily for at least 1 year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.
- B. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of 3 years. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the system. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.

C. The Contractor's Communications Technicians assigned to the system shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the system. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the Project Manager before being allowed to commence work on the system.

D. Applicable national, state and local licenses.

E. Certificate of successful completion of OEM's installation/training school for installing technicians of the equipment being proposed.

1.6 CODES AND PERMITS

A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by the Owner.

B. The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

1.7 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS

A. Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.

B. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.

C. Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and thorough equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special Communications (TVE-0050P3B - herein after referred to as [0050P3B]) will not review any submittal that does not have this list.

D. Provide 4 copies for technical review.

E. Indicate existing head end and distribution equipment (i.e., splitters, amplifiers, couplers, etc.) involved in the distribution of MATV signals to new devices in this project.

F. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.

G. Engineering drawings of the system, showing calculated signal levels at the Head End input and output, each input and output distribution point, and signal level at each telecommunications outlet.

1.8 PROJECT RECORD DOCUMENTS (AS BUILTS)

A. Throughout progress of the work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.

B. The floor plans shall be marked in pen to include the following:

1. All device locations with labels.
2. Conduit locations.
3. Head-end equipment and specific location.
4. Wiring diagram.
5. Labeling and administration documentation.
6. Warranty certificate.
7. System test results.

1.9 WARRANTIES AND GUARANTEE

A. The Contractor shall warrant the installation be free from defect in material and workmanship for a period of 1 year from the date of acceptance of the project by the owner. The Contractor shall agree to remedy covered defects within eight (8) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

B. Refer to Part 4 for applicable System Guarantee requirements.

PART 2 - PRODUCTS AND FUNCTIONAL REQUIREMENTS

2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

A. Furnish and install a complete and fully operational extension of the existing master antenna TV signal distribution system. Include all amplifiers, power supplies, cables, outlets, splitters, couplers, attenuators and all other parts necessary for the reception and distribution of the existing MATV system.

B. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.

C. Expansion Capability: Increase number of outlets in the future by 25 percent above those indicated without adding any internal or external components.

D. Provide reception quality at each outlet equal to or better than that received in the area with individual antennas. Deliver at all television outlets a minimum +6.0 dBmv (2,000 microvolts across 75 Ohms) and maximum of +20 dBmv (20,000 microvolts) for each channel at each outlet.

E. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

F. Meet all FCC requirements regarding low radiation and/or interference of RF signal(s). The system shall be designed to prevent direct pickup of signals from the building structure.

2.2 SYSTEM DESCRIPTION

A. The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection, but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance.

B. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications and be provided with screw type audio connectors.

C. All trunk, branch, and interconnecting cables and unused equipment ports or taps shall be terminated with proper terminating resistors designed for RF, audio and digital cable systems without adapters.

D. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and RF transmission line interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems shall utilize barrier terminal screw type connectors, at a minimum. As an alternate, crimp type connectors installed with a ratchet type installation tool are acceptable provided the cable dress, pairs, shielding, grounding, connections and labeling are the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.

E. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities shall be as indicated on the drawings.

2.3 MANUFACTURERS

A. The products specified shall be new, FCC and UL Listed, and produced by OEM manufacturer of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:

1. Maintains a stock of replacement parts for the item submitted,
2. Maintains engineering drawings, specifications, and operating manuals for the items submitted, and
3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.

B. Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, the item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.

C. The equipment items are the salient requirements of VA to provide an acceptable system described herein.

2.4 PRODUCTS

A. The system distribution amplifier shall have a frequency range of 49-1,000 MHz and shall accommodate a minimum of 35 HDTV channels of programming. Gain of the preamplifier shall be 32dB, with an output level of 48dBmV for each HDTV channel processed. The preamplifier shall utilize a hybrid push-pull amplifier module. The preamplifier shall provide gain and slope control ranges of 8dB and 9dB, respectively.

B. Provide riser rated coaxial cable with a nominal characteristic impedance of 75 Ohms throughout the entire frequency spectrum utilized in this system. Each reel of cable shall be sweep-tested and return-loss tested over the entire frequency range from 50MHz to 750MHz by the manufacturer. Provide RG-11 for backbone distribution and RG-6 for drops from the respective coupler/tap point to each television outlet

as required to achieve the specified signal level. However, all runs over 150' in length shall be RG-11 or .500". C.

Line Splitters:

1. Provide low-radiation line splitters with a flat frequency response from 50MHz to 1,000MHz. Provide units of a hybrid design with a 75- ohm match on input and outputs and a VSWR no greater than 1.4:1.
 2. Two way line splitters shall have a signal loss of not more than 3.5dB at each output.
 3. Four way line splitters shall have a signal loss of not more than 7.2dB at each output.
 4. All unused splitter outputs shall be terminated with 75-Ohm terminations.
 5. Splitters and couplers shall be located in the accessible corridor ceiling space, adjacent the outlet(s) served.
- D. flat screen televisions shall be provided separately by the Owner. E.

Distribution Devices:

1. Distribution Amplifier:

- a. Description: Broadband CATV quality HDTV distribution amplifier. b.

Specifications:

Frequency Range: 49MHz to 1,000MHz.	Channel Loading: 150.
Flatness: +/- .75dB.	Gain: 32dB.
Output Level: +40dBmV.	Gain Control Range: 10dB.
Slope Control Range: 8dB.	Plug in equalizers as needed.
Attenuator options as needed.	

2. Splitters:

- a. Description: RF signal splitter. b.

Specifications:

Frequency Range: 5MHz to 1,000MHz.	Outputs: 2, 3, 4 and 8.
Splitter Loss: less than 12 dB.	RFI Shielding: 120dB.

3. Taps:

- a. Description: Directional Coupler Type Taps.

b. For use in Telecomm closets or accessible cable trays. c.

Specifications:

1. Frequency Range: 5MHz to 1,000MHz.

2. Outputs: 2, 4 and 8.

3. Isolation Tap Value: Varies.

4. Wallplate Bulkhead Connector and Terminators:

a. Description: Wall plates for termination of CATV signals at television sets.

1. Impedance: 75 Ohms.

2. Frequency Band: SUB/VHF/CATV/UHF.

5. "F" Connectors:

a. Coaxial cable connectors and connector inserts shall be designed to provide maximum performance with the cable to be used. Coaxial cables shall be connectorized with the Head End quality 360

degree F or BNC connectors as applicable, meeting or exceeding

standard industry and the cable manufacture's specifications. All drop F-connectors shall be hex type crimp or a "Snap and Seal" type connector.

Housing to housing (KS to KS) type or 90-degree type connectors shall be used where specified by the OEM.

6. Terminator:

a. Description: 75-Ohm terminator. b.

Specifications:

DC blocking.	Bandwidth: 50MHz-890MHz.
Return Loss: greater than 16dB.	Impedance: 75 Ohm.

7. RG6 Cable:

a. Description: CATV RG6 double shielded cable CM Rated. All cabling not installed in conduit shall be provided with a plenum-rated jacket.

b. Specifications:

1. Attenuation:

1.48 dB/100ft at 50 MHz.	7.45 dB/100ft at 1000 MHz.
Impedance: 75 Ohm	

8. RG11 Cable:

a. Description: CATV RG11 cable CM Rated. All cabling not installed in conduit shall be provided with a plenum-rated jacket.

b. Specifications:

1. Attenuation:

0.90 dB/100ft at 50 MHz.	5.04 dB/100ft at 1000 MHz.
Impedance: 75 Ohm	

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

A. Assign a single project manager to this project who will serve as the point of contact for the Owner, the General Contractor, and the Engineer.

3.2 COORDINATION WITH OTHER TRADES

A. Coordinate with the cabling contractor the location of the faceplate and the faceplate opening for the MATV backbox.

B. Coordinate with the cabling contractor the location of MATV equipment in the Telecommunications Closets.

C. Before beginning work, verify the location, quantity, size and access for the following:

1. Junction boxes, wall boxes, conduit stubs and other related infrastructure for the systems.

2. System components installed by others.

3. Overhead supports and rigging hardware installed by others.

D. Immediately notify the Owner, General Contractor and Consultant in writing of any discrepancies.

3.3 INSTALLATION

A. General:

1. Execute work in accordance with National, State and local codes, regulations and ordinances.

2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.

3. Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
4. Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc:
 - a. All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.
 - b. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.
 - c. Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.
 - d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.
5. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommets in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.
- B. Wiring Practice - in addition to the mandatory infrastructure requirements outlined in VA Construction Specification, Section 27 10 00, STRUCTURED COMMUNICATIONS CABLING SYSTEM, the following additional practices shall be adhered to:
 1. Comply with requirements for raceways and boxes specified in Division 26, Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
 2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
 3. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.
 4. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.

5. Replace the entire length of the run of any wire or cable that is damaged or abraided during installation. There are no acceptable methods of repairing damaged or abraided wiring.
6. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
8. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
9. Do not use tape-based or glue-based cable anchors.
10. Ground shields and drain wires as indicated by the drawings.
11. Field wiring entering equipment racks shall be terminated as follows:
 - a. Provide ample service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.
 - b. Employ permanent strain relief for any cable with an outside diameter of 1 inch or greater.
12. Make all connections as follows:
 - a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.
 - b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
 - c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.
 - d. Wire nuts, electrical tape or "Scotch Lock" connections are not acceptable for any application.
- C. Cable Installation - In addition to the mandatory infrastructure requirements outlined in VA Construction Specification, Section 27 10 00, STRUCTURED CABLING the following additional practices shall be adhered to:
 1. Support cable on maximum 4'-0" centers. Acceptable means of cable support are cable tray, j-hooks, and bridal rings. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.
 2. Run cables parallel to walls.

3. Install maximum of 10 cables in a single row of J-hooks. Provide necessary rows of J-hooks as required by the number of cables.
4. Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2'-0" clearance from all shielded electrical apparatus.
5. All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the Owner.
6. Ends of cables shall be properly terminated on both ends per industry and OEM's recommendations.
7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.
8. Cover the end of the overall jacket with a 1 inch (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2 inches (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2 inches (minimum) past the Heatshrink and serve as indicated below.
9. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing 1/4 inch past the end of unused wires, fold back over jacket and secure with cable tie.
10. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.
11. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
12. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
13. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
14. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Labeling:

1. Clearly, consistently, logically and permanently mark amplifiers, switches, connectors, jacks, relays, receptacles and electronic and other equipment.
2. Permanently label cables at each end, including terminal board connections. Labels shall be covered by the same, transparent heat- shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
6. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.
7. Ensure each OEM supplied equipment has permanently attached/marked the appropriate UL Labels/Marks for the service the equipment is performed. Equipment installed not bearing these UL marks will not be allowed to be part of the system. The Contractor shall bear all costs required to provide replacement equipment with approved UL marks.

3.4 CUTTING AND PATCHING

A. It shall be the responsibility of the contractor to keep their work area clear of debris and clean area daily at completion of work.

B. It shall be the responsibility of the contractor to patch and paint any wall or surface that has been disturbed by the execution of this work. C. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.

D. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor, the Contractor's consent to cutting or otherwise altering the work.

E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the location shall be approved by the Project Manager prior to commencement of coring work.

3.5 FIREPROOFING

- A. Where MATV cables penetrate fire rated walls, floors and ceilings, fireproof the opening.
- B. Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.
- C. Use only materials and methods that preserve the integrity of the fire stopping system and its rating.

3.6 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes as specified in Division 26, Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. D. Do not "mix grounds" of different systems.

PART 4 - TESTING/GUARANTEE/TRAINING

4.1 PROOF OF PERFORMANCE TESTING

- A. System Testing:
 - 1. The system shall be tested utilizing the approved test equipment to certify proof of performance and FCC compliance. The test shall verify that the total system meets all the requirements of this specification. After the system has been tested the Contractor shall submit the test results and certification to the Project Manager for review.
 - 2. After the Physical and Mechanical Inspection, the head end terminating and control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum

analyzer and sound level meter shall be utilized to accomplish this requirement.

b. The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last leg to verify that the MATV video, audio and control signals meets all system performance standards.

B. Test Equipment:

1. The test equipment shall furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:

a. Spectrum Analyzer.

b. Signal Level Meter. c. Volt-Ohm Meter.

d. Sound Pressure Level (SPL) Meter. e. Oscilloscope.

4.2 TRAINING

A. Provide thorough training of the owner's engineering and maintenance staff.

B. Provide the following minimum training times and durations:

1. 2 hours prior to opening

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
08-09M

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 27 51 16
PUBLIC ADDRESS/MASS NOTIFICATION AND LOCAL DEPARTMENTAL PAGING SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

A. Work covered by this document includes design, engineering, labor, material and products, equipment warranty and system guarantee, training and services for, and incidental to a complete installation and extension of the existing National Fire Protection Association (NFPA) - Life Safety Code 101.3-2 (a) Labeled and (b) Listed supervised Emergency Service Public Address System (PAS) and associated equipment (here-in-after referred to as the Hospital Page on the contract drawings. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting PAS communications signals generated local and remotely as detailed herein.

B. Work covered by this document includes design, engineering, labor, material and products, equipment warranty and system guarantee, training and services for, and incidental to a complete installation and extension of the existing local overhead Department Paging system, here-in-after referred to as the Department Page on the contract drawings. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting paging signals generated locally within the Radiology Department.

C. Work shall be complete, tested, certified and ready for operation.

D. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.

1.2 RELATED SECTIONS

A. 01 33 23 - Shop Drawings, Product Data and Samples. B.

07 84 00 - Firestopping.

C. 26 05 21 - Low - Voltage Electrical Power Conductors and Cables (600 Volts and Below).

1.3 DEFINITIONS

A. Provide: Design, engineer, furnish, install, connect complete, test, certify and guarantee.

B. Work: Materials furnished and completely installed.

1.4 QUALIFICATIONS

A. The Contractor shall have had experience with three (3) or more installations of systems of comparable size and complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least one (1) year after final acceptance by the user.

Include the names, locations and point of contact for these installations as a part of the submittal.

1.5 CODES AND PERMITS

A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by the Owner.

B. The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

C. The Contractor shall display all applicable national, state and local licenses and permits.

1.6 WARRANTIES / GUARANTY

A. The Contractor shall warrant the installation to be free from defect in material and workmanship for a period of two (2) years from the date of acceptance of the project by the owner. The Contractor shall agree to remedy covered defects within four (4) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

PART 2 - PRODUCTS / FUNCTIONAL REQUIREMENTS

2.0 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

A. Coordinate features and select interface components to connect to the existing overhead Hospital Page System and the existing overhead Departmental Page System. Match components and interconnections for optimum performance of specified functions.

2.1 PRODUCTS

A. General.

1. The Hospital Page speaker shall be a 6.8" diameter, self-contained, white housing, 70V speaker with $\frac{1}{4}$, $\frac{1}{2}$, 1 or 2 W taps. The speaker shall be EST, Inc Genesis Series, Model GC-S7 and match the existing supervised wiring speaker system. Cabling shall be West Penn Model 60993B. Ceiling hangars shall be Quam Model SSB-2

2. The Departmental Page
speakers shall be an 8" speaker with 25V/70V transformer and a 12" round
white grill.

The speakers shall be
G.E./Dukane Model 5A606 with Quam Model SSB-2 ceiling supports and
G.E./Dukane Model 145-226 backboxes.

3. Cabling shall be West Penn 25-224. All cabling not installed in
conduit shall be provided with a plenum-rated jacket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Execute work in accordance with National, State and local codes,
regulations and ordinances.

2. Install work neatly, plumb and square and in a manner consistent with
standard industry practice. Carefully protect work from dust, paint and
moisture as dictated by site conditions. The Contractor
will be fully responsible for protection of his work during the construction
phase up until final acceptance by the Owner.

3. Install equipment according to OEM's recommendations. Provide any
hardware, adaptors, brackets, rack mount kits or other accessories
recommended for correct assembly and installation.

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
01-10

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 27 52 23
NURSE CALL AND CODE BLUE SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

A. Work covered by this document includes design, engineering, labor, material and products, equipment warranty and system guarantee, training and services for, and incidental to, the complete extension of the existing G.E. Telligence/ASCOM Nurse Call System. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting Nurse-Call and Code Blue communications signals generated local and remotely as detailed herein.

B. Work shall be complete, Occupational Safety and Health Administration (OSHA), National Project recognized Testing Laboratory (NRTL - i.e. Underwriters Laboratory [UL]) Listed and Labeled; and VA Central Office (VACO), Telecommunications Voice Engineering (TVE 0050P3B) tested, certified and ready for operation.

C. The System shall be designed, engineered and installed for ease of operation, maintenance, and testing.

D. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, tested, and guaranteed by the Contractor.

1.2 PROJECT MANAGERLATED SECTIONS

A. 01 33 23 - Shop Drawings, Product Data and Samples. B.

07 84 00 - Firestopping.

C. 26 05 21 - Low - Voltage Electrical Power Conductors and Cables (600 Volts and Below).

D. 27 05 11 - Project Requirements for Communications Installations.

1.3 DEFINITION

A. Provide: Design, engineer, furnish, install, connect complete, test, certify and guarantee.

B. Work: Materials furnished and completely installed.

C. Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The engineer's review shall not Project relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.

1.4 QUALIFICATIONS

A. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years.

The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA.

In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System.

This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.

B. The Contractor's Communications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal to the PROJECT MANAGER before being allowed to commence work on the System.

C. The Contractor shall display all applicable national, state and local licenses.

D. The Contractor shall submit copy (s) of Certificate of successful completion of OEM's installation/training school for installing technicians of the System's Nurse Call and/or Code Blue equipment being proposed.

1.5 CODES AND PERMITS

A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested, certified and approved by VA and ready for operation on a date directed by the Owner.

B. The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

1.6 SCHEDULING

A. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The owner will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

1.7 PROJECT RECORD DOCUMENTS (AS BUILTS)

- A. Throughout progress of the Work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project record Documents.
- B. The floorplans shall be marked in pen to include the following:
1. Each device specific locations with UL labels affixed.
 2. Conduit locations.
 3. Each interface and equipment specific location.
 4. Wiring diagram.
 5. Labeling and administration documentation.
 6. Warranty certificate.
 7. System test results.

1.8 WARRANTIES / GUARANTEE

- A. The Contractor shall warrant the installation to be free from defects in material and workmanship for a period of two (2) years from the date of acceptance of the project by the owner. The Contractor shall agree to cover defects within four (4) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.
- B. The Contractor shall agree to guarantee the system according to the guidelines outlined in Article 4 herein.

1.9 USE OF THE SITE

- A. Use of the site shall be at the GC's direction.
- B. Coordinate with the GC for lay-down areas for product storage and administration areas.
- C. Coordinate work with the GC and their sub-contractors.
- D. Access to buildings where the work is performed shall be directed by the GC.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.
- B. Store products in original containers.
- C. Coordinate with the GC for product storage. The Project may be little or no storage space available on site. Plan to potentially store materials off site.
- D. Do not install damaged products. Remove damaged products from the site and replace with new product at no cost to the Owner.

1.11 PROJECT CLOSE-OUT

A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.

B. Before the project closeout date, the Contractor shall submit:

1. OEM Equipment Warranty Certificates.
2. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
3. Project record documents.
4. Instruction manuals that are a part of the system.
5. System Guaranty Certificate.

C. Contractor shall submit written notice that:

1. Contract Documents have been reviewed.
2. Project has been inspected for compliance with contract.
3. Work has been completed in accordance with the contract.

PART 2 - PRODUCTS / FUNCTIONAL PROJECT MANAGERQUIPROJECT MANAGERMENTS

2.0 GENERAL PROJECT MANAGERQUIPROJECT MANAGERMENTS FOR EQUIPMENT AND MATERIALS

A. Furnish and install a complete and fully functional G.E. Telligence/ASCOM Nurse Call System for each location shown on the contract drawings.

2.1 SYSTEM DESCRIPTION

A. Furnish and install a complete and fully functional and operable Nurse Call System.

2.2 MANUFACTURERS

A. The products specified shall be new, FCC and UL Listed, labeled and produced by G.E. Nurse Call. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:

1. Maintains a stock of replacement parts for the item submitted,
2. Maintains engineering drawings, specifications, and operating manuals for the items submitted, and
3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.

B. Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, the item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.

C. Equipment Standards and Testing:

1. The System has been defined herein as connected to systems identified as Critical Service performing various Emergency and Life Support Functions. At a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation, and the OEM recommendations, instructions, and guidelines.
 2. All supplies and materials shall be listed, labeled or certified by UL or a NRTL where such standards have been established for the supplies, materials or equipment.
 3. The provided equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the PROJECT MANAGER approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.
 4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards.
- The placement of the UL Seal
- shall be a permanent part of the electronic equipment that is not capable of being transportable from one equipment item to another.

2.3 PRODUCTS

A. General.

1. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. The equipment quantities provided herein shall be as indicated on the drawings. The nurse call devices shall be

connected to the new nurse call central equipment to be installed in Communication Room 1W234.

2. Nurse call master stations shall be desk mounted, ASCOM Model HC-CONSOLE-E.
3. Audiovisual patient stations shall be wall mounted, ASCOM Model HC- PSTN1-BED with GEN 4 pillow speaker.
4. Emergency/Code Blue pullcord stations shall be ASCOM Model HC-PB3-PRES.
5. Code blue/Staff Assist pushbutton stations shall be ASCOM Model-PP3.
6. Nurse call dome lights shall be ASCOM Model HC-CL4.
7. Duty/Staff stations shall be ASCOM Model HC-DUTY.
8. Cabling shall be 390-EZC (siamese 16/2 with Cat-5e) for dome light to dome light, 800536e (Cat-5e) for Console to IPSWITCH, and dome light to Patient Station, West Penn 25224B for push/pull stations to dome light and West Penn 25241B for pillow speaker TV control. Cabling catalog numbers are based on ASCOM product unless otherwise noted.
9. Nurse central equipment shall be ASCOM HC-IPSWITCH8. Provide a half height wall mounted equipment rack to accommodate nurse call and CCTV rack mounted central equipment. This gateway shall be cabled to the existing nurse call central equipment rack in Nurse Call Com Room 4W103.
10. All cabling not installed in conduit shall be provided with a plenum-rated jacket.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

A. Before beginning work, verify the location, quantity, size and access for the following:

1. Junction boxes, wall boxes, wiring troughs, conduit stubs and other project related infrastructure for the systems.
2. System components installed by others.
3. Overhead supports and rigging hardware installed by others.

B. Immediately notify the Owner, GC and Consultant(s) in writing of any discrepancies.

3.2 INSTALLATION

A. General:

1. Execute work in accordance with National, State and local codes, regulations and ordinances.

2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.
3. Install equipment according to OEM's recommendations. Provide any hardware Engineer, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
4. Secure equipment firmly in place.
5. Color code all distribution wiring to conform to the Nurse Call Industry Standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.
6. Wire or cables shall be installed in conduit.
7. Conduit: The Contractor shall label all conduits with permanent marking devices or spray painted stenciling a minimum of 3 meters

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
01-10

THIS PAGE INTENTIONALLY LEFT BLANK

Division 28

Electronic Safety and Security

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 28 05 00
COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section, Common Work Results for Electronic Safety and Security (ESS), applies to all sections of Division 28.
- B. Furnish and install fully functional electronic safety and security cabling system(s) consisting of extension and expansion of the existing Lenel Access Control and Code Green System and the existing Security Closed Circuit Television System. Furnish and install all equipment and approved accessories in accordance with the specification section(s), drawing(s), and referenced publications to assure fully functional systems.
- C. The Contractor shall provide a fully functional and operating ESS, programmed, configured, documented, and tested as required herein and the respective Safety and Security System Specification(s). The Contractor shall provide calculations and analysis to support design and engineering decisions as specified in submittals. The Contractor shall provide and pay all labor, materials, and equipment, sales and gross receipts and other taxes. The Contractor shall secure and pay for plan check fees, permits, other fees, and licenses necessary for the execution of work as applicable for the project. Give required notices; the Contractor will comply with codes, ordinances, regulations, and other legal requirements of public authorities, which bear on the performance of work.
- D. The Contractor shall provide an ESS, installed, programmed, configured, documented, and tested. The security system shall include but not be limited to: physical access control, intrusion detection, Code Green duress alarms, video assessment and surveillance, expanded video recording and storage, fire alarm interface, equipment cabinetry, and uninterruptible power supplies (UPS) at the access control panels in Communications Room BW201 and the CCTV equipment rack in Communications Room 1W234. Operator training shall not be required as part of the Security Contractors scope and shall be provided by the Owner. The Security Contractor shall still be required to provide necessary maintenance and troubleshooting manuals as well as submittals as identified herein. The work shall include the procurement and installation of electrical wire and cables, the installation and testing of all system components. Inspection, testing, demonstration, and

acceptance of equipment, software, materials, installation, documentation, and workmanship, shall be as specified herein. The

Contractor shall provide all associated installation support, including the provision of primary electrical input power circuits.

E. Repair Service Replacement Parts On-site service during the warranty period shall be provided as specified under "Emergency Service". The

Contractor shall guarantee all parts and labor for a term of one (1) year, unless dictated otherwise in this specification from the acceptance date of the system as described in Part 5 of this Specification. The

Contractor shall be responsible for all equipment, software, shipping, transportation charges, and expenses associated with the service of the system for one (1) year. The Contractor shall

provide 24-hour telephone support for the software program at no additional charge to the owner. Software support shall include all software updates that occur during the warranty period.

F. Section Includes:

1. Description of Work for Electronic Security Systems,
2. Electronic security equipment coordination with relating Divisions,
3. Submittal Requirements for Electronic Security,
4. Miscellaneous Supporting equipment and materials for Electronic Security,
5. Electronic security installation requirements.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements. B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.

C. Section 08 71 00 - DOOR HARDWARE. Requirements for door installation. D. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

E. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

F. Section 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.

G. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

H. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

I. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

J. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.

1.3 QUALITY ASSURANCE

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. Contractor Qualification:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of three (3) years experience installing and servicing systems of similar scope and complexity.

The Contractor shall be an authorized regional representative of the Security Management System's manufacturer.

The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The Contractor shall only utilize factory-trained technicians to install, terminate and service CCTV equipment and access control controller/field panels and reader modules.

The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems.

The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site.

The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract.

The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures.

The Project Manager reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.

2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.

3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.

D. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.4 GENERAL ARRANGEMENT OF CONTRACT DOCUMENTS

A. The Contract Documents supplement to this specification indicates approximate locations of equipment. The installation and/or locations of the equipment and devices shall be governed by the intent of the design; specification and Contract Documents, with due regard to actual site conditions, recommendations, ambient factors affecting the equipment and operations in the vicinity. The Contract Documents are

diagrammatic and do not reveal all offsets, bends, elbows, components, materials, and other specific elements that may be required for proper installation. If any departure from the contract documents is deemed necessary, or in the event of conflicts, the Contractor shall submit details of such departures or conflicts in writing to the owner or owner's representative for his or her comment and/or approval before initiating work.

B. Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called by all, except if a provision clearly designed to negate or alter a provision contained in one or more of the other Contract Documents shall have the intended effect. In the event of conflicts among the Contract Documents, the Contract Documents shall take precedence in the following order: the Form of Agreement; the Supplemental General Conditions; the Special Conditions; the Specifications with attachments; and the drawings.

1.5 SUBMITTALS

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

B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or

installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. 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.

D. 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, quantity of parts, current price and availability of each part.

E. Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breath or depth these requirements will be considered incomplete and rejected.

Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements.

Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted. Additional general provisions are as follows:

1. The Contractor shall schedule submittals in order to maintain the project schedule.

2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.

3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.

4. Manufacturer's information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for

Project Manager and Contractor review stamps.

5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with VA CAD Standards CAD Standard Application Guide, and VA BIM Guide. FREEHAND SKETCHES OR

COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The

Contractor shall not reproduce Contract Documents or copy

standard information as the basis of the Technical Data Drawings. If

departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the Project Manager for approval before the initiation of work.

6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.

a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents.

Provide pockets in the covers to receive folded sheets.

1) Where two (2) or more binders are necessary to accommodate data; correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-

referencing other binders where necessary to provide essential information for communication of proper operation and/or maintenance of the component or system.

2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.

b. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.

c. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.

d. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not

available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches 20 pound white bond paper.

e. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.

1) Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.

2) If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.

3) Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16" tall.

f. Manual Content: 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) The manuals shall include:

a) Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.

b) A control sequence describing start-up, operation, and shutdown.

c) Description of the function of each principal item of equipment.

d) Installation and maintenance instructions.

- e) Safety precautions.
- f) Diagrams and illustrations. g) Testing methods.
- h) Performance data.
- i) Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments.
The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
- j) Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
- g. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.
- h. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address, and telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.
- i. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.
- j. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.
- k. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the

relationship between components of equipment or systems, or provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

l. Manufacturer's Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one

(1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents.

Identify data that is applicable to the installation and delete references to information which is not applicable.

m. Where manufacturer's standard printed data is not available and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual, prepare written text to provide the necessary information. Organize the text in a consistent format under a

separate heading for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.

n. Certifications: Provide section for Contractor's manufacturer certifications.

7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer's catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor's stamp with signature certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.

8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under procedures specified for initial submittals. Identify all changes made since previous submittal.

9. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all of major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.

F. Group 1 Technical Data Package: Group I Technical Data Package shall be one submittal consisting of the following content and organization. Refer to VA Special Conditions Document for drawing format and content requirements. The data package shall include the following:

1. Section I - Drawings:

a. General - Drawings shall conform to VA CAD Standards Guide. All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings.

b. Cover Sheet - Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.

c. General Information Sheets - General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.

d. Floor Plans - Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets.

Security devices shall be placed on drawings in scale.

All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings. Floor plans shall identify the following:

- 1) Security devices by symbol,
 - 2) The associated device point number (derived from the loading sheets),
 - 3) Wire & cable types and counts
 - 4) Conduit sizing and routing
 - 5) Conduit riser systems
 - 6) Device and area detail call outs
- e. Architectural details - Architectural details shall be produced for each device mounting type (door details for EECS and IDS, Intrusion Detection system (motion sensor, vibration, microwave Motion Sensor and Camera mounting,
- f. Riser Diagrams - Contractor shall provide a riser diagram indicating riser architecture and distribution of the SMS throughout the facility (or area in scope).

g. Block Diagrams - Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g., electronic entry control, intrusion detection, closed circuit television, intercom, and other associated subsystems) integration; and data transmission and media conversion methodologies.

h. Interconnection Diagrams - Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.

i. Security Details:

- 1) Panel Assembly Detail - For each panel assembly, a panel assembly details shall be provided identifying individual panel component size and content.
- 2) Panel Details - Provide security panel details identify general arrangement of the security system components, backboard size, wire through size and location, and power circuit requirements.
- 3) Device Mounting Details - Provide mounting detailed drawing for each security device (e.g. physical access control system, intrusion detection, video surveillance and assessment, Code Green, etc) for each type of wall and ceiling configuration in project. Device details shall include device, mounting detail, wiring and conduit routing.
- 4) Details of connections to power supplies and grounding
- 5) Sensor detection patterns - Each system sensor shall have associated detection patterns.
- 6) Equipment Rack Detail - For each equipment rack, provide a scaled detail of the equipment rack location and rack space utilization. Use of BISCII wire management standards shall be employed to identify wire management methodology. Transitions between equipment racks shall be shown to include use vertical and horizontal latter rack system.
- 8) Communications Room Layout - The contractor shall provide a layout plan for the respective Communications Room containing the central equipment. The layout plan shall identify all equipment and details associated with the installation.

The room details shall provide architectural, electrical, mechanical, plumbing, IT/Data and associated equipment and device placements both vertical and horizontally.

j. Door Schedule - A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:

- 1) Item Number
 - 2) Door Number (Derived from A/E Drawings)
 - 3) Floor Plan Sheet Number
 - 4) Standard Detail Number
 - 5) Door Description (Derived from Loading Sheets)
 - 6) Data Gathering Panel Input Number
 - 7) Door Position or Monitoring Device Type & Model Number
 - 8) Lock Type, Model Number & Power Input/Draw (standby/active)
 - 9) Card Reader Type & Model Number
 - 10) Shunting Device Type & Model Number
 - 11) Sounder Type & Model Number
 - 12) Manufacturer
 - 13) Misc. devices as required
 - a) Delayed Egress Type & Model Number
 - b) Intercom
 - c) Camera
 - d) Electric Transfer Hinge
 - e) Electric Pass-through device
 - 14) Remarks column indicating special notes or door configurations
2. Camera Schedule - A camera schedule shall be developed for each camera.

Contractors shall coordinate with the Project Manager to determine camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:

- a. Item Number
- b. Camera Number
- c. Naming Conventions
- d. Description of Camera Coverage
- e. Camera Location
- f. Floor Plan Sheet Number

- g. Camera Type
- h. Mounting Type
- i. Standard Detail Reference j. Power
Input & Draw

k. Power Panel Location

l. Remarks Column for Camera

3. Manufacturers" Data: The data package shall include manufacturers" data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.

4 System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification.

5. Certifications & References: All specified manufacturer"s certifications shall be included with the data package. Contractor shall provide Project references as outlined in Paragraph 1.4 "Quality Assurance".

G. Group II Technical Data Package

1. The Contractor shall prepare a report of "Current Site Conditions" and submit a report to the Project Manager documenting changes to the site, particularly those conditions that affect performance of the system to be installed. The Contractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions which affect the installation of the system or its performance. The Contractor shall not correct any deficiency without written permission from the PROJECT MANAGER. H. Group

III Technical Data Package

1. Development of Test Procedures: The Contractor will prepare performance test procedures for the system testing. The test procedures shall follow the format of the VA Testing procedures and be customized to the contract requirements. The Contractor will deliver the test procedures to the Project Manager for approval at least 60 calendar days prior to the requested test date.

I. Group IV Technical Data Package

1. System Configuration:

a. The contractor is responsible for providing all system configuration for the systems (e.g., video matrix switch, digital video recorders, access control, etc). All data entry shall be

performed per VA standards & guidelines. The Contractor is responsible for participating in all meetings with the client to compile the information needed for data entry. The contractor shall be responsible for all data collection, data entry, and system configuration. The contractor shall collect, enter, & program and/or configure the following components:

- 1) Physical Access control system components,
- 2) All intrusion detection system components,
- 3) Video surveillance, control and recording systems,
- 4) 5) All other security subsystems shown in the contract documents.

J. Group V Technical Data Package: Final copies of the manuals shall be delivered to the Project Manager as part of the acceptance test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each sub-contractor installing equipment or systems, as well as the nearest service representatives for each item of equipment for each system. The manuals shall include a table of contents and tab sheets.

Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. Three (3) hard-copies and one (1) soft copy

on CD of each item listed below shall be delivered as a part of final systems acceptance.

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the entire system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. Manufacturer developed literature may be used; however, shall be produced to match the project requirements.

2. Equipment Manual: A manual describing all equipment furnished including:

a. General description and specifications; installation and checkout procedures; equipment electrical schematics and layout drawings; system schematics and layout drawings; alignment and calibration procedures; manufacturer's repair list indicating sources of supply; and interface definition.

3. Software Manual: The software manual shall describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:

a. Definition of terms and functions; use of system and applications software; procedures for system initialization, start-up, and shutdown; alarm reports; reports generation, database format and data entry requirements; directory of all disk files; and description of all communications protocols including data formats, command characters, and a sample of each type of data transfer.

4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system, including:

a. Computers and peripherals; system start-up and shutdown procedures; use of system, command, and applications software; recovery and restart procedures; graphic alarm presentation; use of report generator and generation of reports; data entry; operator commands' alarm messages, and printing formats; and system access requirements.

5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, recommend schedules, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

6. Spare Parts & Components Data: At the conclusion of the Contractor's work, the Contractor shall submit to the Project Manager a complete list of the manufacturer's recommended spare parts and components required to satisfactorily maintain and service the systems, as well as unit pricing for those parts and components.

7. Operation, Maintenance & Service Manuals: The Contractor shall provide two (2) complete sets of operating and maintenance manuals in the form of an instructional manual for use by the VA Security Guard Force personnel.

The manuals shall be organized into suitable sets of manageable size.

Where possible, assemble instructions for similar equipment into a single binder. If multiple volumes are required, each volume shall be fully indexed and coordinated.

8. Equipment and Systems Maintenance Manual: The Contractor shall provide the following descriptive information for each piece of equipment, operating system, and electronic system:

a. Equipment and/or system function. b. Operating characteristics.

- c. Limiting conditions.
- d. Performance curves.
- e. Engineering data and test.
- f. Complete nomenclature and number of replacement parts.
- g. Provide operating and maintenance instructions including assembly drawings and diagrams required for maintenance and a list of items recommended to stock as spare parts.
- h. Provide information detailing essential maintenance procedures including the following: routine operations, trouble shooting guide, disassembly, repair and re-assembly, alignment, adjusting, and checking.
- i. Provide information on equipment and system operating procedures, including the following; start-up procedures, routine and normal operating instructions, regulation and control procedures, instructions on stopping, shut-down and emergency instructions, required sequences for electric and electronic systems, and special operating instructions.
- j. Manufacturer equipment and systems maintenance manuals are permissible.

9. Project Redlines: During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing current location and configuration of the project components. The redline documents shall be marked with the words „Master Redlines“ on the cover sheet and be maintained by the Contractor in the project office. The Contractor will provide access to redline documents anytime during the project for review and inspection by the Project Manager or authorized Office of Protection Services representative. Master redlines shall be neatly maintained throughout the project and secured under lock and key in the contractor"s onsite project office. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings. Prior to producing Record Construction Documents, the contractor will submit the Master Redline document to the Project Manager for review and approval of all changes or modifications to the documents. Each sheet shall have Project Manager initials indicating authorization to produce "As Built" documents. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered "master redlines".

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI)/ International Code Council (ICC):

A117.1.....Standard on Accessible and Usable Buildings and
Facilities

C. American National Standards Institute (ANSI)/Electronic Industries
Alliance (EIA):

330-09.....Electrical Performance Standards for CCTV
Cameras

375A-76.....Electrical Performance Standards for CCTV
Monitors

D. Architectural Barriers Act (ABA), 1968

E. Department of Justice: American Disability Act (ADA)

28.....FR Part 36-2010 ADA Standards for Accessible
Design

F. Department of Veterans Affairs:

VHA National CAD Standard Application Guide, 2006

VA BIM Guide, V1.0 10

G. Federal Communications Commission (FCC):

(47 CFR 15) Part 15 Limitations on the Use of Wireless
Equipment/Systems

H. Federal Information Processing Standards (FIPS):

FIPS-201-1.....Personal Identity Verification (PIV) of Federal
Employees and Contractors

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.

4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

1.8 MAINTENANCE & SERVICE

A. General Requirements

1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system.

The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work.

Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work.

See also General Project Requirements.

B. Description of Work

1. The adjustment and repair of the security system includes all access control equipment, software updates, panel firmware, local processors, security system sensors, physical access control equipment, and video equipment.

C. Personnel

1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily.

The Project Manager shall be advised in writing of the name of the designated service representative, and of any change in personnel.

The Project Manager shall be provided copies of system manufacturer certification for the designated service representative.

D. Schedule of Work

1. The work shall be performed during regular working hours, Monday through Friday, excluding federal holidays.

1.9 EQUIPMENT AND MATERIALS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
 3. Components shall be compatible with each other and with the total assembly for the intended service.
 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

1.10 ELECTRICAL POWER

A. Electrical power of 120 Volts Alternating Current (VAC) shall be indicated on the Division 26 drawings. Additional locations requiring primary power required by the security system shall be shown as part of these contract documents.

Each access control panel and CCTV controller shall be provided with a UPS back-up device capable of 8 hours of full load operation.

Primary power for the security system shall be configured to switch to emergency backup sources automatically if interrupted without degradation of any critical system function. Alarms shall not be generated as a result of power switching, however, an indication of power switching on (on-line source) shall be provided to the alarm monitor.

B. Failure of any on-line battery shall be detected and reported as a fault condition. Battery backed-up power supplies shall be provided sized for 8 hours of operation at actual connected load. Requirements for additional power or locations shall be included with the contract to support equipment and systems offered.

1.11 TRANSIENT VOLTAGE SUPPRESSION, POWER SURGE SUPPLESION & GROUNDING

A. Transient Voltage Surge Suppression: All cables and conductors extending beyond building façade, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage Surge Suppression (TVSS) protection.

The TVSS device shall be UL listed in accordance with Standard TIA 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 914.4 mm (3 ft) of the building cable entrance. Fuses shall not be used for surge

protection. The inputs and outputs shall be tested in both normal mode and common mode to verify there is no interference.

1. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
2. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
3. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B.
4. Operating Temperature and Humidity: -40 to 85 deg C (-40 to 185 deg F), 0 to 95 percent relative humidity. B.

Grounding and Surge Suppression

1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. To ensure the operation of over current devices, such as fuses, circuit breakers, and relays, under ground-fault conditions.

1.12 COMPONENT ENCLOSURES

A. Construction of Enclosures

1. Consoles, power supply enclosures, detector control and terminal cabinets, control units, wiring gutters, and other component housings, collectively referred to as enclosures, shall be so formed and assembled as to be sturdy and rigid.
2. Thickness of metal in-cast and sheet metal enclosures of all types shall not be less than those in Tables I and II, UL 611. Sheet steel used in fabrication of enclosures shall be not less than 14 gauge. Consoles shall be 16-gauge.
3. Doors and covers shall be flanged. Enclosures shall not have pre-punched knockouts. Where doors are mounted on hinges with exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent removal. Doors having a latch edge length of less than 609.6 mm (24 in) shall be provided with a single construction core. Where the latch edge of a hinged door is more than 609.6 mm (24 in) or more in length, the door shall be provided with a three-point latching device with construction core; or alternatively with two, one located near each end.
4. Any ventilator openings in enclosures and cabinets shall conform to the requirements of UL 611. Unless otherwise indicated, sheet metal enclosures shall be designed for wall mounting with tip holes slotted. Mounting holes shall be in positions that remain accessible when all major operating components are in place and the door is open, but shall be in accessible when the door is closed.

5. Covers of pull and junction boxes provided to facilitate initial installation of the system shall be held in place by tamper proof Torx Center post security screws. Stenciled or painted labels shall

be affixed to such boxes indicating they contain no connections. These labels shall not indicate the box is part of the Electronic Security System (ESS).

B. Consoles & Equipment Racks: All consoles and vertical equipment racks shall include a forced air-cooling system to be provided by others.

1. Vertical Equipment Racks:

a. The forced air blowers shall be installed in the vented top of each cabinet and shall not reduce usable rack space.

b. The forced air fan shall consist of one fan rated at 105 CFM per rack bay and noise level shall not exceed 55 decibels.

c. d. Vertical equipment racks are to be provided with full sized clear plastic locking doors and vented top panels as shown on contract drawings.

1.13 ELECTRONIC COMPONENTS

A. All electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Boards

shall be plug-in, quick-disconnect type. Circuitry shall not be so densely placed as to impede maintenance. All power-dissipating

components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current- carrying capacity.

1.14 SUBSTITUTE MATERIALS & EQUIPMENT

A. Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

B. In addition to this Section the Security Contractor shall also reference Section II, Products and associated divisions. The Project Manager shall have final authority on the authorization or refusal of substitutions.

If there are no proposed substitutions, a statement in writing from the Contractor shall be submitted to the Project Manager stating same.

In the preparation of a list of substitutions, the following information shall be included, as a minimum:

1. Identity of the material or devices specified for which there is a proposed substitution.

- C. Materials Not Listed: Furnish all necessary hardware, software, programming materials, and supporting equipment required to place the specified major subsystems in full operation. Note that some supporting equipment, materials, and hardware may not be described herein. Depending on the manufacturers selected by the PROJECT MANAGER, some equipment, materials and hardware may not be contained in either the Contract Documents or these written specifications, but are required by the manufacturer for complete operation according to the intent of the design and these specifications.

D. Response to Specification: The Contractor shall submit a point-by-point statement of compliance with each paragraph of the security specification.

paragraph number. Where the proposed system does not comply with the paragraph as written, but the bidder feels it will accomplish the intent of the paragraph in a manner different from that described, the offers shall indicate "COMPARABLE". The offers shall include a statement fully

disqualified. Submittals for products shall be in precise order with

the product section of the specification.
sequence will be rejected.

Submittals not in proper

1.15 LIKE ITEMS

A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new, and free of any defects.

1.16 WARRANTY

A. The Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the PROJECT MANAGER certifying all contract requirements have been completed according to the final specifications.

Contract drawings and the warranty of all materials and equipment furnished under this contract are to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this work accepted) for one (1) year from the date the Contractor received written notification of final acceptance from the PROJECT MANAGER. Demonstration and training shall be performed prior to system acceptance. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay, to the PROJECT MANAGER's satisfaction, and at the Contractor's expense.

The Contractor shall provide quarterly inspections during the warranty period. The contractor shall provide written documentation to the PROJECT MANAGER on conditions and findings of the system and device(s).

In addition, the contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the

warranty. The warranty period shall be extended until the last inspection and associated corrective actions are complete. When equipment and labor covered by the Contractor's warranty, or by a manufacturer's warranty, have been replaced or restored because of its failure during the warranty period, the warranty period for the replaced or repaired equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work.

In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

1.17 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.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All equipment shall be UL 827, UL 1981, and UL 60950 compliant and rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.

B. All equipment shall operate on a 120 or 240 volts alternating current (VAC); 50 Hz or 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of 8 hours of run time in the event of a loss of primary power to the facility.

C. The system shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.

D. All equipment and materials for the system will be compatible to ensure correct operation.

E. Access Control Equipment

1. Existing Lenel System

F. Closed circuit Security Television Equipment

1. Camera equipment is noted on the drawings schedule. Performance and catalog numbers are based on AXIS, Inc. unless otherwise noted.

2. CCTV flat panel monitor shall be 22" LED, desk mounted. Performance based on Bosch Model UML-223-90

3. The PC required at each nurse station (2 total) will be owner furnished and installed.

4. Coax cable shall be RG6/U, catalog number 25806. Control cable shall be catalog number 252248. Performance and catalog numbers based on West Penn, Inc.

5. All cabling not installed in conduit shall be provided with a plenum- rated jacket.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.
- F. Equipment location shall be as close as practical to locations shown on the drawings.
- G. Inaccessible Equipment:
 - 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
 - 2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

3.2 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system.

3.3 DEMONSTRATION AND TRAINING

- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.

C. A training schedule shall be developed and submitted by the contractor and approved by the Project Manager at least 30 days prior to the planned training.

D. Provide services of manufacturer's technical representative for <insert hours> hours to instruct VA personnel in operation and maintenance of units.

E. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

3.4 WORK PERFORMANCE

A. Job site safety and worker safety is the responsibility of the contractor.

B. For work on existing stations, arrange, phase and perform work to assure electronic safety and security service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

D. Coordinate location of equipment and conduit with other trades to minimize interferences. See the GENERAL CONDITIONS.

3.5 SYSTEM PROGRAMMING

A. General Programming Requirements

1. This following section shall be used by the contractor to identify the anticipated level of effort required to setup, program, and configure the Electronic Security System (ESS). The contractor shall be responsible for providing all setup, configuration, and programming to include data entry for the Security Management System (SMS) and subsystems (e.g., video matrix switch, digital video recorders, intrusion devices, including integration of subsystems).

3.6 TESTING AND ACCEPTANCE

A. Performance Requirements

1. General:

a. The Contractor shall perform contract field, performance verification, and endurance testing and make adjustments of the completed security system when permitted.

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing.

Written notification of planned

testing shall be given to the Project Manager at least 60 calendar days prior to the test and after the Contractor has received written approval of the specific test procedures.

2. Test Procedures and Reports: The test procedures, compliant w/ VA standard test procedures, shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification.

The test reports shall be used to document results of the tests. The reports shall be delivered to the Project Manager within seven (7) calendar days after completion of each test.

B. The inspection and test will be conducted by a factory-certified contractor representative and witnessed by a Government Representative. The results of the inspection will be officially recorded by a designated Government Representative and maintained on file by the Project Manager, until completion of the entire project. The results

will be compared to the Acceptance Test results.

C. Contractor's Field Testing (CFT)

1. The Contractor shall calibrate and test all equipment, verify DTM operation, place the integrated system in service, and test the integrated system. Ground rods installed by this Contractor within the base of camera poles shall be tested as specified in IEEE STD

142. The Contractor shall test all security systems and equipment, and provide written proof of a 100% operational system before a date is established for the system acceptance test. Documentation package for CFT shall include completed (fully annotated details of test details) for each device and system tested, and annotated loading sheets documenting complete testing to Project Manager approval. CFT test

documentation package shall conform to submittal requirements outlined in this Section. The Contractor's field testing procedures shall be identical to

the Project Manager's acceptance testing procedures. The Contractor shall provide the Project Manager with a written listing of all equipment and software indicating all

equipment and components have been tested and passed. The Contractor

shall deliver a written report to the Project Manager stating the installed complete system has been calibrated, tested, and is ready

to begin performance verification testing; describing the results of the functional tests, diagnostics, and calibrations; and the report shall also include a copy of the approved acceptance test procedure. Performance verification testing shall not take place until written

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
9-11

notice by contractor is received certifying that a contractors field test was
successful.

- - - E N D - - -

SECTION 28 05 13
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing and certification the conductors and cables required for a fully functional for electronic safety and security (ESS) system.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements. B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.

C. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.

D. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SECURITY AND SAFETY. Requirements for infrastructure.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

F. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

G. RCDD: Registered Communications Distribution Designer.

H. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

I. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

J. UTP: Unshielded twisted pair.

1.4 QUALITY ASSURANCE

A. See section 28 05 00, Paragraph 1.4.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

1. Manufacturer's Literature and Data: Showing each cable type and rating.
2. Certificates: Two weeks prior to final inspection, deliver to the Project Manager/COTR four copies of the certification that the material is in accordance with the drawings and specifications and diagrams for cable management system.
3. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to side of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
 - e. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
4. Wiring Diagrams. Show typical wiring schematics including the following:
 - a. Workstation outlets, jacks, and jack assemblies.
 - b. Patch cords.
 - c. Patch panels.
5. Cable Administration Drawings: As specified in Part 3 "Identification" Article.
6. Project planning documents as specified in Part 3.
7. Maintenance Data: For wire and cable to include in maintenance manuals.

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 the basic designation only.

B. American Society of Testing Material (ASTM):

D2301-04.....Standard Specification for Vinyl Chloride
Plastic Pressure Sensitive Electrical Insulating
Tape

C. Federal Specifications (Fed. Spec.):

A-A-59544-08.....Cable and Wire, Electrical (Power, Fixed
Installation)

D. National Fire Protection Association (NFPA):

70-11.....National Electrical Code (NEC) E.

Underwriters Laboratories, Inc. (UL):

44-05.....Thermoset-Insulated Wires and Cables

83-08.....Thermoplastic-Insulated Wires and Cables

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

486A-03.....Wire Connectors and Soldering Lugs for Use with
Copper Conductors

486C-04.....Splicing Wire Connectors

486D-05.....Insulated Wire Connector Systems for Underground
Use or in Damp or Wet Locations

486E-00.....Equipment Wiring Terminals for Use with Aluminum and/or
Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and
Branch Circuit Cable

514B-04.....Fittings for Cable and Conduit

1479-03.....Fire Tests of Through-Penetration Fire Stops

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to
end. Use optical loss test set.

2. Test optical fiber cable on reels. Use an optical time domain
reflectometer to verify the cable length and locate cable defects, splices,
and connector; include the loss value of each. Retain test
data and include the record in maintenance data.

3. Test each pair of UTP cable for open and short circuits.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP, optical
fiber, and coaxial cables and connecting materials until wet work in spaces
is complete and dry, and temporary HVAC system is operating and maintaining
ambient temperature and humidity conditions at occupancy levels during the
remainder of the construction period.

PART 2 - PRODUCTS

2.1 GENERAL

A. General: All cabling locations shall be in conduit systems as outlined in Division 28 unless a waiver is granted in writing or an exception is noted on the construction drawings.

B. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.

2. Lacing bars, spools, J-hooks, and D-rings.

3. Straps and other devices. C.

Cable Trays:

1. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by hot-dip galvanizing, complying with ASTM A 123/A 123M Grade 0.55, not less than 0.002165 inch (0.055 mm) thick.

2. Basket Cable Trays: 12 inches wide and 4 inches deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).

D. Conduit and Boxes: Comply with requirements in Division 28 Section "Conduits and Backboxes for Electrical Systems."

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

E. All cabling not installed in conduit shall be provided with a plenum-rated jacket.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4" by 48" by 96" (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

2.3 UTP CABLE

A. Description: 100-ohm, 4-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.

2. Comply with TIA/EIA-568-B.1 for performance specifications.

3. Comply with TIA/EIA-568-B.2, Category 6.

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

b. Communications, Riser Rated: Type CMR, complying with UL 1666.

c. Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG.

2.4 UTP CABLE HARDWARE

A. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

B. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

A. Description: Multimode, 50/125 micrometer, 48, 24 or 12 strand as noted on the drawings tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.

2. Comply with TIA/EIA-568-B.3 for performance specifications.

3. Comply with TIA/EIA-492AAAA-B for detailed specifications.

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

a. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.

b. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.

5. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

B. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable.

2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.

3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

1. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss shall be not more than 0.75 dB.

2.7 COAXIAL CABLE

A. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications.

Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

B. RG-6/U: NFPA 70, Type CATV or CM.

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.

2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.

3. Jacketed with black PVC or PE.

4. Suitable for indoor installations.

C. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Plenum Rated: Type CATVP, complying with NFPA 262.

2.8 COAXIAL CABLE HARDWARE

A. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 IDENTIFICATION PRODUCTS

A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14- A and TIA/EIA-568-B.3.

E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

2.11 WIRE LUBRICATING COMPOUND

A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

B. Shall not be used on wire for isolated type electrical power systems.

2.12 FIREPROOFING TAPE

A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

- B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
- D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Terminate all conductors; no cable shall contain un-terminated elements.
 - Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 9. Pulling Cable:
 - a. Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
 - b. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - c. Use ropes made of nonmetallic material for pulling feeders.

- d. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Project Manager/COTR.
- e. Pull in multiple cables together in a single conduit.
- C. Splice cables and wires where necessary only in outlet boxes, junction boxes, or pull boxes.
 - 1. Splices and terminations shall be mechanically and electrically secure.
 - 2. 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.
- D. 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.
- E. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- F. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- G. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- H. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- I. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.
- J. UTP Cable Installation:
 - 1. Comply with TIA/EIA-568-B.2.
 - 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- K. Optical Fiber Cable Installation:
 - 1. Comply with TIA/EIA-568-B.3.
 - 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- L. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- M. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.
- N. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
- O. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).

- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
- 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.2 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Division 28 Section CONDUITS AND BACKBOXES FOR ELECTRICAL SYSTEMS."
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
 - 1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 - 2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is not permitted.
 - 3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all

connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 CONTROL CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.4 CONNECTIONS

- A. Comply with requirements in Division 28 Section, PHYSICAL ACCESS CONTROL for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Division 28 Section "INTRUSION DETECTION" for connecting, terminating, and identifying wires and cables.
- C. Comply with requirements in Division 28 Section "VIDEO SURVEILLANCE" for connecting, terminating, and identifying wires and cables.
- D. Comply with requirements in Division 28 Section "ELECTRONIC PERSONAL PROTECTION SYSTEMS" for connecting, terminating, and identifying wires and cables.
- E. Comply with requirements in Division 28 Section "FIRE DETECTION AND ALARM" for connecting, terminating, and identifying wires and cables.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "PENETRATION FIRESTOPPING."

- B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 28 Section "GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY."

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.
- B. Install a permanent wire marker on each wire at each termination.
- C. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- D. Wire markers shall retain their markings after cleaning.
- E. In each handhole, install embossed brass tags to identify the system served and function.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 4. Optical Fiber Cable Tests:

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

b. Link End-to-End Attenuation Tests:

1) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.

2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

5. Coaxial Cable Tests: Comply with requirements in Division 27 Section "Master Antenna Television System."

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.9 EXISTING WIRING

A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
09-11

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 28 05 26
GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing and certification of the grounding and bonding required for a fully functional Electronic Safety and Security (ESS) system.

B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, grounding electrodes. C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 26 41 00 - FACILITY LIGHTNING PROTECTION. Requirements for a lightning protection system.

C. Section 28 05 00 - REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS. For general electrical requirements, quality assurance, coordination, and project conditions that are common to more than one section in Division 28.

D. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for low voltage power and lighting wiring.

1.3 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

B. Shop Drawings:

1. Clearly present enough information to determine compliance with drawings and specifications.

2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

C. Test Reports: Provide certified test reports of ground resistance.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Project Manager:

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.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. 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

C. 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

D. National Fire Protection Association (NFPA):

70-11.....National Electrical Code (NEC)

99-2005.....Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):

44-05Thermoset-Insulated Wires and Cables

83-08Thermoplastic-Insulated Wires and Cables

467-07Grounding and Bonding Equipment

486A-486B-03Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be solid copper.

Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm² (4 AWG) and larger shall be permitted to be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

2.2 SPLICES AND TERMINATION COMPONENTS

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).
- B. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- C. Below Grade: Exothermic-welded type connectors.
- D. Above Grade:
 - 1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
 - 2. Connection to Building Steel: Exothermic-welded type connectors.
 - 3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
 - 4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.
 - 5. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - a) Pipe Connectors: Clamp type, sized for pipe.
 - 6. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 EQUIPMENT RACK AND CABINET GROUND BARS

- A. Provide a solid copper grounding bar, designed for wall mounting on standoff insulators, in each communication room (BW201 and 1W234). Bus bars shall be (2 inch wide x 1/4 inch thick x 18 inch) and connected to adjacent building steel.

2.4 GROUND TERMINAL BLOCKS

- A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.5 SPLICE CASE GROUND ACCESSORIES

- A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm² (6 AWG).

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 CORROSION INHIBITORS

A. 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.

3.4 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 WIREWAY GROUNDING

A. Ground and Bond Metallic Wireway Systems as follows:

1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm² (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated 16 mm² (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 16 meters (50 feet).
3. Use insulated 16 mm² (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.
4. Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

3.6 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to earth ground externally to the building. Under no condition shall the electrical system's third of fourth ground electrode system, or the telecommunications system circulating ground system be connected to the lightning protection system. The Facility's structural steel may be used to connect the lightning protection system at the direction of the Project Manager certified by an independent certified grounding contractor.

3.7 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided. Provide a written test report demonstrating the resistance value of the ground system.

C. Below-grade connections shall be visually inspected by the Project Manager prior to backfilling. The contractor shall notify the Project Manager 24 hours before the connections are ready for inspection.

3.8 LABELING

A. Comply with requirements in Division 26 Section "ELECTRICAL IDENTIFICATION" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections. B.

Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare and submit test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power Distribution Units or Panel boards Serving Electronic

Equipment: 3 ohm(s).

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

- - - E N D - - -

SECTION 28 05 28.33
CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing certification of the conduit, fittings, and boxes to form a complete, coordinated, raceway system(s). Conduits and when approved separate UL Certified and Listed partitioned telecommunications raceways are required for a fully functional Electronic Safety and Security (ESS) system. Raceways are required for all electronic safety and security cabling unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 06 10 00 - ROUGH CARPENTRY. Requirements for mounting board for communication closets.

C. Section 07 84 00 - FIRESTOPPING. Requirements for sealing around penetrations to maintain the integrity of fire rated construction.

D. Section 07 60 00 - FLASHING AND SHEET METAL. Requirements for fabrications for the deflection of water away from the building envelope at penetrations.

E. Section 07 92 00 - JOINT SEALANTS. Requirements for sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

F. Section 09 91 00 - PAINTING. Requirements for identification and painting of conduit and other devices.

G. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

For general electrical requirements, general arrangement of the contract documents, coordination, quality assurance, project conditions, equipment and materials, and items that is common to more than one section of Division 28.

H. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit. H.
- NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

A. Refer to Paragraph 1.4 Quality Assurance, in Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

1.5 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Furnish the following:

B. Shop Drawings:

1. Size and location of main feeders;
2. Size and location of panels and pull boxes
3. Layout of required conduit penetrations through structural elements.
4. The specific item proposed and its area of application shall be identified on the catalog cuts.

C. Certification: Prior to final inspection, deliver to the Project Manager/COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

D. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

E. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

F. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

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 referenced in the text by the basic designation only.

B. National Electrical Manufacturers Association (NEMA):

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
C. National Fire Protection Association (NFPA):
70-11.....National Electrical Code (NEC) D.
Underwriters Laboratories, Inc. (UL):
1-05.....Flexible Metal Conduit
5-04.....Surface Metal Raceway and Fittings
6-07.....Rigid Metal Conduit
50-07.....Enclosures for Electrical Equipment
360-09.....Liquid-Tight Flexible Steel Conduit
467-07.....Grounding and Bonding Equipment
514A-04.....Metallic Outlet Boxes
514B-04.....Fittings for Cable and Conduit
514C-02.....Nonmetallic Outlet Boxes, Flush-Device Boxes and
Covers
651-05.....Schedule 40 and 80 Rigid PVC Conduit
651A-07.....Type EB and A Rigid PVC Conduit and HDPE Conduit
797-07.....Electrical Metallic Tubing
1242-06.....Intermediate Metal Conduit

PART 2 - PRODUCTS

2.1 GENERAL

A. Conduit Size: In accordance with the NEC, but not less than 20 mm (3/4 inch) unless otherwise shown.

2.2. CONDUIT

A. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1. B.

Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.

C. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.

D. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3.

Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 volts or less.

E. Flexible galvanized steel conduit: Shall Conform to UL 1.

F. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

G. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

2.3. WIREWAYS AND RACEWAYS

A. Surface metal raceway: Shall Conform to UL 5.

2.4. CONDUIT FITTINGS

A. Rigid steel and IMC conduit fittings:

1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
4. 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.
5. 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.
6. 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.

B. Rigid aluminum conduit fittings:

1. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
2. Locknuts and bushings: As specified for rigid steel and IMC conduit.
3. Set screw fittings: Not permitted for use with aluminum conduit. C.

Electrical metallic tubing fittings:

1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
4. Indent type connectors or couplings are prohibited.

5. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
- D. Flexible steel conduit fittings:
1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
 2. Clamp type, with insulated throat.
- E. Liquid-tight flexible metal conduit fittings:
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
 2. Only steel or malleable iron materials are acceptable.
 3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- F. Direct burial plastic conduit fittings:
1. Fittings shall meet the requirements of UL 514C and NEMA TC3.
 2. As recommended by the conduit manufacturer.
- G. Surface metal raceway fittings: As recommended by the raceway manufacturer.
- H. Expansion and deflection couplings:
1. Conform to UL 467 and UL 514B.
 2. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 3. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
 4. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.5 CONDUIT SUPPORTS

- A. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
- B. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
- C. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
- D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

2.6 OUTLET, JUNCTION, AND PULL BOXES

- A. UL-50 and UL-514A.

B. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.

E. Sheet metal boxes: Galvanized steel, except where otherwise shown.

F. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

2.7 CABINETS

A. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

B. Hinged door in front cover with flush latch and concealed hinge. C. Key latch to match panelboards.

D. Metal barriers to separate wiring of different systems and voltage. E. Accessory feet where required for freestanding equipment.

2.8 WIREWAYS

A. Equip with hinged covers, except where removable covers are shown.

2.9 WARNING TAPE

A. Standard, 4-Mil polyethylene 76 mm (3 inches) wide tape non-detectable type, red with black letters, and imprinted with "CAUTION BURIED ELECTRONIC SAFETY AND SECURITY CABLE BELOW".

2.10 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 84 00 "FIRESTOPPING."

2.11 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Pressure Plates: Carbon steel. Include two for each sealing element. EZ Path product as manufactured by Specified Technologies Inc., or equivalent.

2.12 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Project Manager/COTR prior to drilling through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Project Manager/COTR as required by limited working space.

B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, "JOINT SEALANTS".

3.2 INSTALLATION, GENERAL

A. Install conduit as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically continuous.
6. Independently support conduit at 2.4 m (8 foot) on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling

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

7. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, "FLASHING AND SHEET METAL".
12. Do not use aluminum conduits in wet locations.
13. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

B. Conduit Bends:

1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the Project Manager/COTR.

D. Fire Alarm:

1. Fire alarm conduit shall be painted red (a red "top-coated" conduit from the conduit manufacturer may be used in lieu of painted conduit) in accordance with the requirements of Section 28 31 00, "FIRE DETECTION AND ALARM".

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only when the following occurs:

- a. Where shown on the structural drawings.
- b. As approved by the Project Manager/COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
- 4. Installation of conduit in concrete that is less than 75 mm (3 inch) thick is prohibited.
 - a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
 - b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
 - c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
- 5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.
- B. Furred or Suspended Ceilings and in Walls:
 - 1. Conduit for conductors above 600 volts:
 - a. Rigid steel or rigid aluminum.
 - b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
 - 2. Conduit for conductors 600 volts and below:
 - a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
 - 3. Align and run conduit parallel or perpendicular to the building lines.
 - 4. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (6 feet) of flexible metal conduit extending from a junction box to the fixture.
 - 5. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors 600 volts and below:
 - 1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed 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 2400 mm (eight foot) intervals.

F. Surface metal raceways: Use only where shown. G.

Painting:

1. Paint exposed conduit as specified in Section 09 91 00, "PAINTING".
2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, "PAINTING" for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 EXPANSION JOINTS

A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 75 mm (3 inches) and larger conduits are acceptable.

C. Install expansion and deflection couplings where shown.

3.6 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
2. Existing Construction:

- a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
- b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
- c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable. H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.7 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - 1. Flush mounted.
 - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes).
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

G. On all Branch Circuit junction box covers, identify the circuits with black marker.

3.8 ELECTRONIC SAFETY AND SECURITY CONDUIT

A. Install the electronic safety and security raceway system as shown on drawings.

B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

H. All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
$\frac{3}{4}$	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

J. Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in _____ on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.

K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
09-11

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 28 16 11
CODE GREEN NOTIFICATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install Code Green pushbuttons as indicated on the drawings and connect to the existing Lenel control panel located in Room 3W100.

1.2 RELATED WORK

A. For fire stopping application and use, Section 07 84 00, FIRESTOPPING. B. For electrical installation, Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

C. For power cables, Section 26 05 21, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).

D. For grounding of equipment, Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

E. For infrastructure, Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

F. For General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

A. The Contractor shall be responsible for providing, installing, and maintaining the operation of the Code Green system as shown. The Contractor shall also provide certification as required.

B. The Code Green system shall be installed and tested to ensure all components are fully compatible as a system.

1.4 SUBMITTALS

A. Submit below items in conjunction with Master Specification Sections 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1. Drawing sheets that will be plotted on the individual floor plans or site plans shall:

a. Include a title block as defined above.

b. Define the drawings scale in both standard and metric measurements.

c. Provide device identification and location.

d. Address all signal and power conduit runs and sizes that are associated with the design.

2. A riser drawing, showing the new portion of the Code Green system, shall include shall:

a. Indicate the sequence of operation.

b. Relationship of the existing Lenel control panel and the new Code Green buttons.

c. Include the number, size, identification, and maximum lengths of interconnecting wires.

d. Wire/cable types shall be defined by a wire and cable schedule.

The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. General

1. Code Green buttons shall be wall mounted as noted on the drawings. Each button shall be Potter Electric Signal, Model HUB-M, with the recessed initiating button directed down. All wiring shall be concealed. Conduit shall be provided from each backbox to the adjacent low voltage cable tray system.

2. Furnish and install and all cabling, connections, terminations, electronics, etc as required for a fully operational system.

3. The system shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.

4. All equipment and materials for the system will be compatible to ensure functional operation in accordance with requirements.

5. Multiple Code Green buttons at a common desk shall be combined to annunciate as a single point.

6. All cabling not installed in conduit shall be provided with a plenum-rated jacket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Code Green System installation shall be in accordance with Underwriters Laboratories (UL) Standards.

3.2 TESTS AND TRAINING

A. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

- - - END - - -

SECTION 28 23 00
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Extend and install a complete Video Surveillance System, which is identified as the Video Assessment and Surveillance System hereinafter referred to as the VASS System as specified in this section. The system shall interface with the existing VASS System currently in place within the facility

B. This Section includes video surveillance system consisting of cameras, data transmission wiring, power supplies, housings, mounting brackets etc for a complete installation.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements. B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.

C. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

D. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

E. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.

F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

G. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

H. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

1.3 QUALITY ASSURANCE

A. The Contractor shall be responsible for providing, installing, and the operation of the VASS System as shown. The Contractor shall also provide certification as required.

B. The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is

stand-alone or a part of a complete Information Technology (IT) computer network.

C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.

D. 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.

E. 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.

F. Contractor Qualification:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of three (3) years experience installing and servicing systems of similar scope and complexity.

The Contractor shall be an authorized regional representative of the Video Assessment and Surveillance System's (VASS) manufacturer. The

Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the

references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project.

The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system.

The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the VASS.

The Contractor shall only utilize factory-trained technicians to

install, terminate and service cameras, control, and recording equipment. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The PROJECT MANAGER reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.

2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.

3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.

G. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.4 SUBMITTALS

A. Submit below items in conjunction with Master Specification Sections 01 33 23, Shop Drawings, Product Data, and Samples, and Section 02 41 00, Demolition.

B. Provide certificates of compliance with Section 1.4, Quality Assurance. C. Provide a pre-installation and as-built design package in both electronic format and on paper, minimum size 1220 x 1220 millimeters (48 x 48 inches); drawing submittals shall be per the established project schedule.

D. Pre-installation design and as-built packages shall include, but not be limited to:

1. Index Sheet that shall:

- a. Define each page of the design package to include facility name, building name, floor, and sheet number.
- b. Provide a list of all security abbreviations and symbols.
- c. Reference all general notes that are utilized within the design package.
- d. Specification and scope of work pages for all security systems that are applicable to the design package that will:
 - 1) Outline all general and job specific work required within the design package.
 - 2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
2. Floor plans, site plans, and enlarged plans shall:
 - a. Include a title block as defined above.
 - b. Define the drawings scale in both standard and metric measurements.
 - c. Provide device identification and location.
 - d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).
 - e. Identify all pull box and conduit locations, sizes, and fill capacities.
 - f. Address all general and drawing specific notes for a particular drawing sheet.
3. A riser drawing for each applicable security subsystem shall:
 - a. Indicate the sequence of operation.
 - b. Relationship of integrated components on one diagram.
 - c. Include the number, size, identification, and maximum lengths of interconnecting wires.
 - d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.
4. A system drawing for each applicable security system shall:

- a. Identify how all equipment within the system, from main panel to device, shall be laid out and connected.
- b. Provide full detail of all system components wiring from point-to-point.
- c. Identify wire types utilized for connection, interconnection with associate security subsystems.
- d. Show device locations that correspond to the floor plans.
- e. All general and drawing specific notes shall be included with the system drawings.
5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
 - a. Device ID.
 - b. Device Location (e.g. site, building, floor, room number, location, and description).
 - c. Mounting type (e.g. flush, wall, surface, etc.).
 - d. Power supply or circuit breaker and power panel number.
 - e. In addition, for the VASS Systems, provide the camera ID, camera type (e.g. fixed or pan/tilt/zoom (P/T/Z), lens type (e.g. for fixed cameras only) and housing model number.
6. Detail and elevation drawings for all devices that define how they were installed and mounted.
- E. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.
- F. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):

330-09.....Electrical Performance Standards for CCTV

Cameras

375A-76.....Electrical Performance Standards for CCTV

Monitors

C. Institute of Electrical and Electronics Engineers (IEEE):

C62.41-02.....IEEE Recommended Practice on Surge Voltages in
Low-Voltage AC Power Circuits

802.3af-08.....Power over Ethernet Standard

D. Federal Communications Commission (FCC):

(47 CFR 15) Part 15 Limitations on the Use of Wireless
Equipment/Systems

E. National Electrical Contractors Association (NECA):

303-2005.....Installing Closed Circuit Television (CCTV)
Systems

F. National Fire Protection Association (NFPA):

70-08.....Article 780-National Electrical Code

G. Federal Information Processing Standard (FIPS):

140-2-02.....Security Requirements for Cryptographic Modules

H. Underwriters Laboratories, Inc. (UL):

983-06.....Standard for Surveillance Camera Units

3044-01.....Standard for Surveillance Closed Circuit
Television Equipment

1.6 COORDINATION

A. Coordinate arrangement, mounting, and support of video surveillance
equipment:

1. To allow maximum possible headroom unless specific mounting heights that
reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum
interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be
clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves
in cast-in-place concrete, masonry walls, and other structural
components as they are constructed.

C. Coordinate location of access panels and doors for video surveillance items that are behind finished surfaces or otherwise concealed.

1.7 WARRANTY OF CONSTRUCTION

A. Warrant VASS System work subject to the Article "Warranty of Construction".

B. Demonstration and training shall be performed prior to system acceptance.

PART 2 - PRODUCTS

2.1 GENERAL

A. Video signal format shall comply with the NTSC standard composite video, interlaced. Composite video signal termination shall be 75 ohms.

B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

C. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

2.2 CAMERAS

A. All Cameras will be EIA 330 and UL 1. Minimum Protection for Power Connections 120 V and more: Auxiliary panel suppressors shall comply with requirements in Section 28 05 00 COMMON WORK REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY, Part 2.

B. Minimum Protection for Communication, Signal, Control, and Low-Voltage 983 compliant as well as:

1. Will be charge coupled device (CCD) cameras and shall conform to National Television System Committee (NTSC) formatting.

2. Fixed cameras shall be color and the primary choice for monitoring following the activities described below. Pan/Tilt/Zoom (P/T/Z) cameras shall be color and are to be utilized to complement the fixed cameras.

3. Shall be powered by either 12 volts direct current (VDC) or 24 volts alternate current (VAC). Power supplies shall be Class 2 and UL

compliant and have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the VASS System.

4. Shall be powered over Ethernet. Network switches supporting PoE cameras shall have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the VASS System.

5. Shall be rated for continuous operation under the environmental conditions listed in Part 1, Project Conditions.

6. Will be home run to a monitoring and recording device via a controlling device such as a matrix switcher or network server and monitored on a 24 hour basis at a designated Security Management System location.

7. Each function and activity shall be addressed within the system by a unique user defined name, with minimum of twenty (20) characters.

The use of codes or mnemonics identifying the VASS action shall not be accepted.

8. Shall come with built-in video motion detection that shall automatically monitor and process information from each camera. The camera motion detection shall detect motion within the camera's field of view and provide automatic visual, remote alarms as a result of detected motion.

9. Shall be programmed to digitally flip from color to black and white at dusk and vice versa at low light conditions.

10. Will be fitted with AI/DC lenses to ensure the image quality under different light conditions.

11. P/T/Z cameras shall be utilized in a manner that they complement fixed cameras and shall not be used as a primary means of monitoring activity.

12. Appropriate signage shall be designed, provided, and posted that notifies people that an area is under camera surveillance.

2.3 VIDEO MANAGEMENT SYSTEM (ANALOG)

A. The Video Management System (VMS) is existing to remain.

2.4 VIDEO CAMERAS

A. The cameras shall be high-resolution color video cameras with wide dynamic range capturing capability. Cameras shall be IP based as indicated on the drawings.

B. The camera shall meet or exceed the following specifications:

1. The image capturing device shall be a 1/3-inch image sensor designed for capturing wide dynamic images.

a. The image capturing device shall have a separate analog-to-digital converter for every pixel.

b. The image capturing device shall sample each pixel multiple times per second.

c. The dynamic range shall be 95 dB typical and 120 dB maximum.

3. The camera shall optimize each pixel independently.

4. The camera shall have onscreen display menus for programming of the camera's settings.

5. The signal system shall be NTSC.

C. The camera shall have composite video output.

D. The camera shall come with a manual varifocal lens.

E. The video output shall be composite: 1.0 volts peak-to-peak at 75-ohm load.

F. Fixed Color Camera

1. The camera shall be a high-resolution color video camera with wide dynamic range capturing capability.

2. Comply with UL 639.

3. Pickup Device: 1/3CCD interline transfer.

4. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.

5. With AGC, manually selectable on or off.

6. Manually selectable modes for backlight compensation or normal lighting.

7. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.

8. White Balance: Auto-tracing white balance, with manually selectable fixed balance option. atmosphere.

6. All electrical and signal cables required for correct operations shall be supplied in a hardened carrier system from the controller to the camera.

7. The mounting bracket shall be adjustable to allow for the housing weight of the camera and the housing unit it is placed in.

8. Accessibility to the camera and mounts shall be taken into consideration for maintenance and service purposes.

9. The mount shall contain a manual pan/tilt head that will provide 360 degrees of horizontal and vertical positioning from a horizontal position, and has a locking bar or screw to maintain its fixed position once it has been adjusted.

2.5 POWER SUPPLIES

A. Power supplies shall be a low-voltage power supplies matched for voltage and current requirements of cameras and accessories

2.6 WIRES AND CABLES

A. Shall meet or exceed the manufactures recommendation for power and signal.

B. Will be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.

C. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.

D. All conduit, pull boxes, and junction boxes shall be clearly marked with colored permanent tape or paint that will allow it to be distinguished from all other conduit and infrastructure.

E. Conduit fills shall not exceed 50 percent unless otherwise documented.

F. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.

G. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area

H. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security system shall be defined as any cable or sets of cables carrying 30 VDC/VAC or higher.

I. For all equipment that is carrying digital data between the Physical Access Control System and Database Management or at a remote monitoring station, shall not be less that 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable

shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.

J. All cables and conductors, except fiber optic cables, that act as a control, communication, or signal lines shall include surge protection. Surge protection shall be furnished at the equipment end and additional triple electrode gas surge protectors rated for the application on each wire line circuit shall be installed within 1 m. (3 ft.) of the building cable entrance. The inputs and outputs shall be tested in both normal and common mode using the following wave forms:

1. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and peak current of 60 amperes.
2. An 8 microsecond rise time by 20 microsecond pulse width wave form with a peak voltage of 1000 volts and peak current of 500 amperes.

K. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. Fuses and relays shall not be used as a means of surge protection.

L. Coaxial Cables

1. All video signal cables for the VASS System, with exception to the PoE cameras, shall be RG-6/U coaxial cable and have a characteristic impedance of 75 ohms plus or minus 3 ohms.

All cabling not
installed in conduit shall be provided with a plenum-rated jacket.

PART 3 - EXECUTION

3.1. GENERAL

A. Installation: The Contractor shall install all system components including Owner furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2 and as shown, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable data transmission system.

B. Identification and Labeling: The Contractor shall supply permanent identification labels for each cable at each end that will appear on the as-built drawings. The labeling format shall be identified and a complete record shall be provided to the Owner with the final documentation. Each cable shall be identified by type or signal being carried and termination points. The labels shall be printed on letter size label sheets that are self laminated vinyl that can be printed

from a computer data base or spread sheet. The labels shall be E-Z code WES12112 or equivalent.

1. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing.

C. Transient Voltage Surge Suppressors (TVSS): The Contractor shall mount TVSS within 3 m (118 in) of equipment to be protected inside terminal cabinets or suitable NEMA 1 enclosures. Terminate off-premise conductors on input side of device. Connect the output side of the device to the equipment to be protected. Connect ground lug to a low impedance earth ground (less than 10 ohms) via Number 12 AWG insulated, stranded copper conductor.

D. Contractor's Field Test: The Contractor shall verify the complete operation of the data transmission system during the Contractor's Field Testing. Field test shall include a bit error rate test. The Contractor shall perform the test by sending a minimum of 1,000,000 bits of data on each DTM circuit and measuring the bit error rate. The bit error rate shall not be greater than one (1) bit out of each 100,000 bits sent for each dial-up DTM circuit, and one (1) bit out of 1,000,000 bits sent for each leased or private DTM circuit. The Contractor shall submit a report containing results of the field test. E.

Acceptance Test and Endurance Test: The wire line data transmission system shall be tested as a part of the completed IDS and EECS during the Acceptance test and Endurance Test as specified.

F. Identification and Labeling: The Contractor shall supply identification tags or labels for each cable. Cable shall be labeled at both end points and at intermediate hand holes, manholes, and junction boxes. The labeling format shall be identified and a complete record shall be provided to the Owner with the final documentation. Each cable shall be identified with type of signal being carried and termination points.

3.2 INSTALLATION

A. System installation shall be in accordance with NECA 303, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.

B. Components shall be configured with appropriate "service points" to pinpoint system trouble in less than 30 minutes.

C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.5 of this document, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

D. The VASS System will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or a complete network.

3.3 SYSTEM START-UP

A. The Contractor shall not apply power to the VASS System until the following items have been completed:

1. VASS System equipment items and have been set up in accordance with manufacturer's instructions.
2. A visual inspection of the VASS System has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
3. System wiring has been tested and verified as correctly connected as indicated.
4. All system grounding and transient protection systems have been verified as installed and connected as indicated.
5. Power supplies to be connected to the VASS System have been verified as the correct voltage, phasing, and frequency as indicated.

B. The Project Manager, or designated representative, will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Project Manager. Provide a minimum of 7 days prior notice.

C. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work efforts.

3.4 DEMONSTRATION AND TRAINING

A. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, "GENERAL REQUIREMENTS".

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

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
10-11

-

- - END - - -

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the specifications includes the extension, installation, and connection of the existing Simplex 4100 ES fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances and wiring as shown on the drawings and specified.

B. Fire alarm systems shall comply with requirements of the most recent VA FIRE PROTECTION DESIGN MANUAL and NFPA 72 unless variations to NFPA 72 are specifically identified within these contract documents by the following notation: "variation". The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the Project Manager or his authorized representative. Installers shall have a minimum of 2 years experience installing fire alarm systems.

C. Fire alarm signals:

1. Fire alarm signals and operation shall match the existing signals in the adjacent spaces.

1.2 SCOPE

A. An extension of the existing fully addressable Simplex 4100 ES fire alarm system shall be designed and installed in accordance with the specifications and drawings. Device location and wiring runs shown on the drawings are for reference only unless specifically dimensioned. Actual locations shall be in accordance with NFPA 72 and this specification.

B. Existing fire alarm control equipment shall be used.

C. Fire alarm equipment shown on the drawings, and associated cabling, shall be new.

1.3 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

Requirements for procedures for submittals.

B. Section 07 84 00 - FIRESTOPPING. Requirements for fire proofing wall penetrations.

1.4 SUBMITTALS

A. General: Submit three copies in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Drawings:

1. Prepare drawings using AutoCAD Release 14 software and include all contractors' information. Layering shall be by VA criteria as provided by the Contracting Officer's Technical Representative (PROJECT MANAGER). Bid drawing files on AutoCAD will be provided to the Contractor at the pre-construction meeting. The contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.

2. Floor plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), number, size, and type of raceways and conductors in each raceway; and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions.

3. Detailed wiring diagrams: Provide for fire alarm devices and connection to existing fire alarm system diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures and equipment configuration. C.

Certifications:

1. Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name

and title of the manufacturer's representative who makes the certification.

2. Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.

3. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

1.5 WARRANTY

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable.

B. National Fire Protection Association (NFPA):

NFPA 20..... Standard for the Installation of Stationary Pumps for Fire Protection, 2010 edition

NFPA 70.....National Electrical Code (NEC), 2010 edition

NFPA 72.....National Fire Alarm Code, 2010 edition

NFPA 90A.....Standard for the Installation of Air Conditioning and Ventilating Systems, 2009 edition

NFPA 101.....Life Safety Code, 2009 edition

C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory

D. Factory Mutual Research Corp (FM): Approval Guide, 2007-2011

E. American National Standards Institute (ANSI):

S3.41.....Audible Emergency Evacuation Signal, 1990 edition, reaffirmed 2008

F. International Code Council, International Building Code (IBC), 2009 edition

PART 2- PRODUCTS

2.1 EQUIPMENT AND MATERIALS, GENERAL

A. All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturers' requirements and that satisfactory total system operation has been achieved.

2.2 CONDUIT, BOXES, AND WIRE

A. Conduit shall be in accordance with the following:

1. All conduits shall be installed in accordance with NFPA 70.
2. Conduit fill shall not exceed 40 percent of interior cross sectional area.
3. Conduit shall be 3/4 inch (19 mm) minimum. B.

Wire:

1. Wiring shall be in accordance with NEC article 760 and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.

2. All fire alarm system wiring shall be installed in conduit.

C. Terminal Boxes, Junction Boxes, and Cabinets:

1. Shall be galvanized steel in accordance with UL requirements.
2. All boxes shall be sized and installed in accordance with NFPA 70.
3. Covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 3/4 inch (19 mm) high.
4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.
5. Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser. Terminal strips shall be labeled as specified or as approved by the PROJECT MANAGER.

2.3 FIRE ALARM CONTROL PANEL AND DEVICES

A. General:

1. The Simplex 4100 ES fire alarm control panel is existing. B.

Fire Alarm Chime/Strobes:

1. Xenon flash tube type minimum 15 candela in toilet rooms and 75 candela in all other areas with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72). Strobes shall be Wheelock RSS-24MCW-FR
2. Backplate shall be red with 1/2 inch (13 mm) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.
3. Strobes may be combined with the audible notification appliances specified herein.
4. Chime shall be electric, utilizing solid state electronic technology operating on a nominal 24 VDC.
5. Chime shall have a minimum nominal rating of 80 dBA at 10 feet (3,000 mm).
6. Mount on removable adapter plates on junction boxes.
7. Chime/strobes shall be Wheelock CH70-24MCW-FR. C.

Smoke Detectors:

1. Smoke detectors shall be photoelectric type and UL listed for use with the fire alarm control unit being furnished.
2. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
3. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
4. All spot type and duct type detectors installed shall be of the photoelectric type.
5. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.

6. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

7. Ceiling smoke detectors shall be Simplex 4098-9792 (base) and 4098-9714 (sensor). Each duct mounted smoke detector shall be Simplex

4098-9756 with a 2098-9797 sampling tube and a 2098-9806 Remote Test/Reset Station. D.

Addressable Relays

1. Addressable relays shall be used for fan shutdown operation. Relay modules shall be Simplex MAPNET 2190-9163.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment manufacturer. Fire alarm wiring shall be installed in conduit. All penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING.

B. All conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

C. All new and reused exposed conduits shall be painted in accordance with Section 09 91 00, PAINTING to match surrounding finished areas and red in unfinished areas.

D. All existing accessible fire alarm conduit in the demolition area shall be removed.

E. All fire and alarm system devices shall be flush mounted when located in finished areas.

F. Strobes shall be flush wall mounted with the bottom of the unit located 80 inches (2,000 mm) above the floor or 6 inches (150 mm) below ceiling, whichever is lower. Locate and mount to maintain a minimum 36 inches (900 mm) clearance from side obstructions.

3.2 TESTS

A. Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the

adjustments and tests for the system. Make all adjustments and tests in the presence of the PROJECT MANAGER.

B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the PROJECT MANAGER. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract requirements. After the system has passed the initial test and been approved by the PROJECT MANAGER, the contractor may request a final inspection.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
3. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.
4. Open each alarm initiating and notification circuit to see if trouble signal actuates.
5. Ground each alarm initiation and notification circuit and verify response of trouble signals.

3.3 FINAL INSPECTION AND ACCEPTANCE

A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.

B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article 3.2 TESTS and those required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a VA representative.

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS
10-11

- - - END - - -

Division 31

Earthwork

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 20 00
EARTH MOVING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:

1. Site preparation.
2. Excavation.
3. Filling and backfilling.
4. Grading.
5. Soil Disposal.
6. Clean Up.

1.2 DEFINITIONS:

A. Unsuitable Materials:

1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than (3 inches); organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 45 and 23 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 3percent of optimum moisture content at time of compaction, as defined by ASTM D 698.

Where low plasticity clay is used for fill minimum moisture content must be within 2% of optimum.

2. Existing Subgrade (Except Footing Subgrade): Same materials as

1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.

3. Existing Subgrade (Footings Only): Same as paragraph 1, but no fill or backfill. If materials differ from reference borings and design requirements, excavate to acceptable strata subject to Project Manager's approval.

B. Building Earthwork: Earthwork operations required in area enclosed by a line located 5 feet outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.

- C. Trench Earthwork: Trenchwork required for utility lines.
- D. Site Earthwork: Earthwork operations required in area outside of a line located 5 feet outside of principal building perimeter and within new construction area with exceptions noted above.
- E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D2922.
- F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- G. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- H. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the Project Manager. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- I. Authorized additional excavation: Removal of additional material authorized by the Project Manager based on the determination by the Government's soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
- K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- M. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- N. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the springline of the pipe.

O. Sub-base Course: Layer placed between the sub-grade and a concrete pavement or walk.

P. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

Q. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.

R. Contaminated soils: Soil that contains contaminants as defined and determined by the Project Manager or the Government's testing agency.

1.3 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

C. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

D. Foundation system requirements: Section 31 63 26, DRILLED CAISSONS.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

1.5 SUBMITTALS:

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

B. Furnish to Project Manager:

1. Contactor shall furnish resumes with all personnel involved in the project including Project Manager, Superintendent, and on-site Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.

2. Soil samples.

- a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
- b. Laboratory compaction curve in accordance with ASTM D 698 for each on site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
- c. Test reports for compliance with ASTM D 2940 requirements for subbase material.
- d. Pre-excavation photographs and videotape in the vicinity of the existing structures to document existing site features, including surfaces finishes, cracks, or other structural blemishes that might be misconstrued as damage caused by earthwork operations.
 - e. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.

1.6 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):

D448-03aStandard Classification for Sizes of Aggregate for Road and Bridge Construction

D698-00a1Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft³ (600 kN m/m³))

D1556-00Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D2167-94 (2001)Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2487-06Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System) D2922-05

.....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods

(Shallow Depth)

D2940-03Standard Specifications for Graded Aggregate Material for Bases or Subbases for Highways or Airports

C. Society of Automotive Engineers (SAE):

J732-92Specification Definitions - Loaders

J1179-02Hydraulic Excavator and Backhoe Digging Forces

PART 2 - PRODUCTS

2.1 MATERIALS:

A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.

B. Fills: Material in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. On site soils in compliance with CL, CL-ML, SP, SP-SC may be suitable for use with some sorting to remove unsuitable materials and debris. Material approved from on site or off site sources having a minimum dry density of 110 pcf, a maximum Plasticity Index of 23, and a maximum Liquid Limit of 45 or less.

C. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 1 1/2- inch sieve and not more than 12 percent passing a No. 200 sieve, per ASTM D2940;.

D. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1 inch sieve and not more than 8 percent passing a No. 200 sieve.

E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1 1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

F. Granular Fill:

1. Under concrete slab, crushed stone or gravel graded from 1 inch to No. 4, per ASTM D 2940.

2. Bedding for storm sewer pipe, crushed stone or gravel graded from 1/2 inch to No 4, per ASTM D 2940.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Medical Center.

B. Grubbing: Remove stumps and roots 3 inch and larger diameter.

Undisturbed sound stumps, roots up to 3 inch diameter, and nonperishable solid objects a minimum of 3 feet below subgrade or finished embankment may be left.

C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from areas within 15 feet of new construction and 7.5 feet of utility lines when removal is approved in advance by Project Manager. Remove materials from Medical Center Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in construction area. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer to trees and shrubs that are to remain, than farthest extension of their limbs.

D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by Project Manager. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 1/2 cubic foot in volume, from

soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 2 inches in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed.

E. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 12 inches on each side of widest part of trench excavation and insure final score lines are approximately parallel

unless otherwise indicated. Remove material from Medical Center.

F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.

1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes.

Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.

2. Proposed spot elevations and contour lines have been developed utilizing the existing conditions survey and developed contour lines and may be approximate.

Notify Project Manager of any differences between existing or constructed grades, as compared to those shown on the plans.

3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.

4. Finish grading is specified in Section 32 90 00, PLANTING.

G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheet piling and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the Project Manager, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.

1. Design of the temporary support of excavation system is the responsibility of the Contractor.

2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the Project Manager.

3. Extend shoring and bracing to a minimum of 5 feet below the bottom of excavation. Shore excavations that are carried below elevations of

adjacent existing foundations.

4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor shall provide a concrete fill support under disturbed foundations, as directed by Project Manager, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by Project Manager.

B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from Project Manager. Approval by the Project Manager is also required before placement of the permanent work on all subgrades.

C. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations.

Do not use excavated trenches as temporary drainage ditches.

When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the Project Manager.

D. Proofrolling:

1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with a fully loaded dump truck (gross weight 15 and 20 tons for parking and drive areas respectively) to check for pockets of soft material.

2. Proofrolling shall consist of at least two complete passes with one pass being in a direction perpendicular to preceding one. Remove any areas that deflect, rut, or pump excessively during proofrolling, or that fail to consolidate after successive passes to suitable soils and replaced with compacted fill. Maintain subgrade until succeeding operation has been accomplished.

3. Corrective measures may be required to increase subgrade stability during subgrade preparation. A minimum of 2 ft. of crushed stone should be used to stabilize the basement subgrade soils. Stabilization may be required in pavement areas if unstable conditions are encountered.

The crushed stone base should not be used as a working surface and some redressing or correction of the base should be anticipated due to migration of fines.

E. Building Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Excavate foundation excavations to solid undisturbed subgrade.
3. Remove loose or soft materials to a solid bottom.
4. Fill excess cut under footings or foundations with 3000 psi concrete poured separately from the footings.
5. Do not tamp earth for backfilling in footing bottoms, except as specified.
6. Slope grades to direct water away from excavations and to prevent ponding.

F. Trench Earthwork:

1. Utility trenches (except storm sewer):
 - a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
 - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.
 - c. Support piping on undisturbed earth unless a mechanical support is shown.
 - d. Length of open trench in advance of piping laying shall not be greater than is authorized by Project Manager.
2. Storm sewer trenches:
 - a. Trench width below a point 6 inches above top of pipe shall be 24 inches maximum for pipe up to and including 12 inches diameter, and four-thirds diameter of pipe plus 8 inches for pipe larger than 12 inches. Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
 - b. Bed bottom quadrant of pipe on undisturbed soil or granular fill.
 - 1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 12 inches above top of pipe shall be clean earth placed and tamped by hand.
 - 2) Granular Fill: Depth of fill shall be a minimum of 3 inches plus one sixth of pipe diameter below pipe to 12 inches above top of pipe. Place and tamp fill material by hand.

c. Place and compact as specified remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.

G. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by Project Manager as unsuitable, and replace with acceptable material. When unsuitable material is encountered and removed, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on volume in cut section only.

1. Site Grading:

- a. Provide a smooth transition between adjacent existing grades and new grades.
- b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
 - 1) Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2) Walks: Plus or minus 1 inch.
 - 3) Pavements: Plus or minus 1 inch.
- d. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10 foot straightedge.

3.3 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact

with backfill have been installed and work inspected and approved by Project Manager.

B. Placing: Place materials in horizontal layers not exceeding 9 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand- operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.

C. Compaction: Compact with approved tamping rollers, sheepfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 10 feet of new or existing building walls without prior approval of Project Manager. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 as specified below:

1. Fills, Embankments, and Backfill

a. Under proposed foundations and within 12" of paved areas, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material in accordance with ASTM D698 98 percent.

b. Above foundations, below slabs and more than 12" below pavements:
ASTM D698 95 percent.

c. Curbs, curbs and gutters, ASTM D698 98 percent.

d. Under Sidewalks, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material in accordance with ASTM D698 95 percent.

e. Landscaped areas, top 16 inches, ASTM D698 85 percent.

f. Landscaped areas, below 16 inches of finished grade, ASTM D698 90 percent.

2. Natural Ground (Cut or Existing)

a. Under foundations and with 12" of paved areas 12 inches, 98 percent.

b. Curbs, curbs and gutters, top 12 inches, ASTM d698 98 percent. c. Under sidewalks, top 12 inches, ASTM D698 95 percent.

3. Backfill placed in non-structural areas adjacent to building walls shall be placed in thin lifts and compacted using hand operated equipment to at least 95% but no more than 98% of ASTM D698.

3.4 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

B. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside building away from building walls for a minimum distance of 6 feet.

D. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.

E. Finished grade shall be at least 6 inches below bottom line of window or other building wall openings unless greater depth is shown.

F. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 6 inches unless otherwise shown.

G. Finish subgrade in a condition acceptable to Project Manager at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.

H. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

B. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

C. Segregate all excavated contaminated soil designated by the Project Manager from all other excavated soils, and stockpile on site on two 6 mil polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.6 CLEAN UP:

Upon completion of earthwork operations, clean areas within contract

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

limits, remove tools, and equipment. Provide site clear, clean, free of debris,
and suitable for subsequent construction operations. Remove all debris,
rubbish, and excess material from Medical Center Property

- - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies performance of dewatering required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

1.2 SUMMARY:

A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:

1. Implementation of the Erosion and Sedimentation Control Plan.
2. Dewater excavations, including seepage and precipitation.

B. The Contractor shall be responsible for providing all materials, equipment, labor, and services necessary for care of water and erosion control. Excavation work shall not begin before the Erosion and Sedimentation Control Plan is in place.

1.3 REQUIREMENT:

A. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least 1 foot below lowest foundation subgrade or bottom of pipe trench and to allow material to be excavated in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.

B. Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of 1 foot below prevailing excavation surface.

C. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.

D. Maintain stability of sides and bottom of excavation.

E. Construction operations are performed in the dry. F.

Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:

1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared

subbase

and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.

2. Erosion is controlled.

3. Flooding of excavations or damage to structures does not occur.

4. Surface water drains away from excavations.

5. Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.

G. Permitting Requirements: The contractor shall comply with and obtain the required State and County permits where the work is performed.

1.4 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Submittal requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.11, PHYSICAL DATA.

E. Excavation, backfilling, site grade and utilities: Section 31 20 00, EARTH MOVING.

1.5 SUBMITTALS:

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

B. Drawings and Design Data:

1. Submit drawings and data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation.

2. Material shall include: location, depth and size of wellpoints, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water from site to adequate disposal.

3. Include a written report outlining control procedures to be adopted if dewatering problem arises.

4. Materials submitted shall be in a format acceptable for inclusion in required permit applications to any and all regulatory agencies

for which permits for discharge water from the dewatering system are required due to the discharge reaching regulated bodies of water.

C. Inspection Reports.

D. All required permits.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install a dewatering system to lower and control ground surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of structure foundations, utilities and other excavations.

B. In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of 1 foot below prevailing excavation surface at all times.

3.2 OPERATION:

A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.

B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

3.3 WATER DISPOSAL:

A. Dispose of water removed from the excavations in such a manner as:

1. Will not endanger portions of work under construction or completed.
2. Will cause no inconvenience to Government or to others working near site.
3. Will comply with the stipulations of required permits for disposal of water.

4. Will Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The Contractor shall provide, operate, and maintain all

ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.

B. Excavation Dewatering:

1. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
4. The Contractor shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.

C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

3.4 STANDBY EQUIPMENT:

Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain de- watering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

3.5 CORRECTIVE ACTION:

If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), perform work necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by Contractor, at no additional cost to Government.

3.6 DAMAGES:

Immediately repair damages to adjacent facilities caused by dewatering operations.

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

3.7 REMOVAL:

Insure compliance with all conditions of regulating permits and provide such information to the Project Manager. Obtain written approval from Project Manager before discontinuing operation of dewatering system.

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 31 16

TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Soil treatment with termiticide.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood preservative treatment by pressure process.

1.3 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

1.4 SUBMITTALS

A. Product Data: For termiticide.

1. Include the EPA-Registered Label for termiticide products.

B. Product Certificates: For termite control products, signed by product manufacturer.

C. Qualification Data: For Installer of termite control products.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:

1. Date and time of application.

2. Moisture content of soil before application.

3. Brand name and manufacturer of termiticide.

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes, and rates of application used.

6. Areas of application.

7. Water source for application.

E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite

control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from a single manufacturer for each product.

D. Preinstallation Conference: Conduct conference at Project site to schedule application of termiticide products.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA- Registered Label and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Termiticides:

- a. Aventis Environmental Science USA LP; Termidor.
- b. Bayer Corporation; Premise 75.
- c. Dow AgroSciences LLC; Dursban TC, Equity.

d. FMC Corporation, Agricultural Products Group;
Talstar,

Prevail FT, Torpedo.

e. Syngenta; Demon TC.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3. Crawlspace: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.

4. Masonry: Treat voids.

5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

-

- - END - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 63 26
DRILLED CAISSONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies excavation and concrete required for construction of foundation caissons.

1.2 DEFINITIONS

A. Satisfactory Bearing Material: Bedrock and is assumed to occur at bottom of caisson elevations shown.

1.3 RELATED WORK

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA

C. Earth excavation: Section 31 20 00, EARTH MOVING.

D. Concrete, including materials and mixes: Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.4 CONTRACT BASIS

A. Contract price for caissons will be based upon total length for each type of caisson shown and number of caisson load tests indicated in the Contract Documents. Length of caissons will be measured from bottom elevation to top elevation of the caisson. The diameter of the caisson is defined as the minimum diameter of the shaft.

1. Adjustment of contract price shall be based upon total length of each type of caisson placed and not on the length of individual caissons. When the total length of each type of completed caisson is greater or less than the length shown due to unsuitable soils or design modifications by the Project Manager, contract price adjustment will be made in accordance with Articles, DIFFERING SITE

CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable.

2. Contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable, when artificial materials that are not shown are encountered.

1.5 CLASSIFICATION OF EXCAVATION

A. Soil/Weathered Rock Excavation:

Soil or weathered rock that can be reasonably excavated with the rock auger, i.e. rock auger advancement greater than 6 inches per 15 minutes (see rock auger refusal, 1.5.C-2, below)

B. Sloping Weathered Rock Excavation:

Excavation of soil/weathered rock that can typically be excavated with the rock auger, except when the steeply sloping orientation of the stratum causes the rock auger to run askew.

C. Rock Excavation:

1. Excavation of material that meets the rock auger refusal criteria and requires the rock core barrel or other hard rock excavation techniques for removal.

2. Rock auger refusal is defined as a penetration rate of less than 6 inches in 15 minutes, while operating a caisson drilling rig, rated with a torque capacity of at least 1,000,000 inch-pounds, applying a continuous down pressure of at least 50,000 pounds, equipped with a rock auger that contains conical carbide-tipped ("Kennemetal")

teeth.

D. Nominal Soil or Weathered Rock Seams:

Nominal soil or weathered rock seams below rock auger refusal will be excavated and considered as rock for rock excavation quantities. A nominal soil or weathered rock seam is one which is less than 2 feet thick. Where soil or weathered rock seams or voids of 2 feet or greater are excavated within a mixed rock/soil or rock/weathered rock profile, excavation is classified as soil/weathered rock excavation until rock auger refusal is again established.

1.6 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION

A. Measurement: Excavation type in units of length shall be considered to change at the upper contact with a different excavation type as defined by section 1.5.

B. Payment: Contract unit rates per length of each type of caisson shall be provided for each excavation condition type noted above in Section 1.5. Contract price and time will be adjusted for overruns or underruns in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable.

C. Payment for Differing Site Conditions: No payment will be made for any rock excavation beyond caisson limits unless additional excavation is directed by the Project Manager. When rock excavation, as classified, is encountered, contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES- SUPPLEMENT of the GENERAL CONDITIONS as applicable.

1.7 TOLERANCES

A. Install caissons with not more than the lesser of 1/24th of caisson shaft diameter or 3 inches from design center location. Caissons shall not be out of plumb more than 1 inch in 10 feet for the full depth. Cross sections of shafts shall not be less than design dimensions.

1.8 SUBMITTALS

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

B. Before beginning work, submit a detailed location plan and description of the proposed method of caisson installation, all of which shall be subject to the review and approval of the Project Manager.

C. Shop Drawings shall comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Furnish shop drawings prepared by a Professional Engineer licensed in the State of the project for the detailing, fabricating, bending, and placing of concrete reinforcement.

D. Submit a detailed plan showing load test arrangement, location, and Contractor's qualifications and results for review and approval by the Project Manager.

E. Reports:

1. Caisson record: Data as specified.
2. Rock excavation: Data as specified.
3. Soil Testing Agency Reports shall be issued showing material type and allowable bearing capacity at bottom of shaft within 24 hours after observing each caisson.
4. Certified, "Caisson Field Record" for each caisson recording actual elevation of bottom, elevation of rock (if applicable), final centerline location of top, variation of shaft from plumb, bell dimension (if applicable), result of all tests and observations performed, material type and actual allowable bearing capacity of bottom, depth of socket into rock, levelness of bottom, seepage of

water, still water level (if allowed to flood), elevation (top and bottom) of lining left in place, variation of shaft diameter (from those shown), and evidence of seams, voids or channels below bottom.

F. Certificates: Contractor's qualifications as specified: Experienced specialty piling subcontractor having a minimum of 5 years successful experience installing Work of the same type required for this project. Employ only skilled tradesmen who are thoroughly experienced with the materials and equipment to be used in the Work.

G. Independent Testing and Inspection Agency: The Contractor shall retain an Independent Testing and Inspection Agency (Agency) to document, monitor, and observe production pile work. This Agency shall submit field reports for caisson installations, and grout testing and inspection. They shall submit a caisson installation report for each caisson no later than three days after the installation is complete.

H. Qualification Data: For Installer, Land Surveyor, and Testing and Inspection Agency.

I. Upon completion of caisson installations, the Contractor shall submit five copies of drawings indicating actual in-place pile locations. The Contractor shall pay for all surveying costs. Drawings must be submitted prior to beginning any pile cap or mat installation. One electronic copy of the drawings shall be submitted in AutoCAD DWG format on CD-ROM.

J. Record drawings at Project closeout according to Division 01 Section "Closeout Procedures."

1.9 QUALITY CONTROL

A. Contractor's Quality Control Responsibilities: Contractor is solely responsible for quality control of the Work.

B. A Quality Control Program shall be submitted by the Contractor at least two weeks prior to the commencement of work. The implementation of a Contractor Quality Control Program does not relieve the Contractor from the responsibility to provide work in accordance with the Contract Documents, applicable codes, regulations, and Governing Authorities.

C. Contractor's Independent Testing and Inspection Agency (Agency): The Contractor shall retain at his own expense, the services of a qualified Independent Testing and Inspection Agency, licensed in the state of the project, to provide testing and inspection services during the installation of all foundation piling involved in this Work. This firm

shall also provide consultation services to the Contractor if problems are encountered during the execution of the Work. The Agency shall be primarily concerned with the testing and construction methods which will result in finished foundation piling of the required quality and strength. The Agency shall also be concerned with preventing settlement and/or damage to surrounding structures, roads, utilities, embankments, etc., both within the property lines and on adjoining properties during the construction.

D. The Agency shall be experienced in the testing and installation of caisson foundations. It shall have been involved in at least 8 different caisson projects in the last 5 years, and shall have experience in recommending, testing, and specifying caissons for similar subsurface conditions.

E. Survey Work: The Contractor shall engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for caissons. The surveyor shall record actual measurements of each caisson's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.

F. Contractor's Grout Mix Designer: The Contractor shall employ, at his own expense, a testing laboratory to design grout mixes, conduct tests and submit reports for the design mixes. The Grout Mix Designer shall be qualified according to ASTM C1077 and ASTM E329 to perform material evaluation tests and to design concrete mixes, as documented according to ASTM E548.

G. Welding Standards: Qualify procedures and personnel according to the following:

1. AWS D1.1
2. AWS D1.4

H. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

1.10 QUALITY ASSURANCE

A. The Contractor shall retain the services of a Geotechnical Consultant (Consultant) to provide general observation of all pile operations and to provide technical advice to the Owner with regard to pile operations and performance.

B. The Consultant shall have been involved in at least 8 different caisson installation projects in the last 5 years, and shall have experience in recommending, testing, and specifying caissons for similar subsurface conditions.

1.11 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):

A36/A36M-08.....Standard Specification for Carbon Structural
Steel

A283/A283M-03(2007).....Standard Specification for Low and Intermediate
Tensile Strength Carbon Steel Plates

A615/A615M-09b.....Standard Specification for Deformed and Plain
Carbon Steel Bars for Concrete Reinforcement

A929/A929M-01(2007).....Standard Specification for Steel Sheet, Metallic
Coated by the Hot Dip Process for Corrugated Steel Pipe

A996/A996M-09b.....Standard Specification for Rail Steel and Axle Steel
Deformed and Bars for Concrete Reinforcement

C33-11a.....Standard Specification for Concrete Aggregates

C94/C94M-12.....Standard Specification for Ready Mixed Concrete C150-

C50M-11.....Standard Specification for Portland Cement C494/C494M-

11.....Standard Specification for Chemical Admixtures
for Concrete

C618-12.....Standard Specification for Coal Fly Ash and Raw or
Calcined Natural Pozzolan for Use in
Concrete

C989-C989M-11.....Standard Specification for Slag Cement for Use in
Concrete and Mortars

C1017/C1017M-07.....Standard Specification for Chemical Admixtures
for Use in Producing Flowing Concrete

D1143-81(1994)e1.....Standard Test Method for Piles Under Static
Axial Compressive Load

D3689-90(1995).....Standard Test Method for Individual Piles Under
Static Axial Tensile Load

D3966-90 (1995).....Standard Test Method for Piles Under Lateral
Loads

C. American Concrete Institute (ACI):

211.1-91 (2009).....Standard Practice for Selecting Proportions for
Normal, Heavyweight and Mass Concrete

301-10.....Specifications for Structural Concrete

315-99.....Details and Detailing of Concrete Reinforcement

D. American Welding Society (AWS):

D1.1/D1.DM (2010).....Structural Welding Code - Steel

D1.4 (1998).....Structural Welding Code - Reinforcing Steel

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Reinforcement: ASTM A615/A615M, or 996, Grade 60, deformed. B.

Portland Cement: ASTM C150, Type I or II.

C. Fly Ash/Slag:

1. Fly Ash Admixture: ASTM C618, Class C or F.

2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120. D.

Normal-Weight Aggregate: ASTM C33, uniformly graded, 3/4-inch maximum
aggregate size.

E. Water: Potable, complying with ASTM C94/C94M requirements.

F. Admixtures: Certified by manufacturer to contain not more than 0.1 percent
water-soluble chloride ions by mass of cementitious material and to be
compatible with other admixtures and cementitious materials. Do not use
admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494, Type A.

2. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

3. High-Range, Water-Reducing Admixture: ASTM C494, Type G.

4. Plasticizing and Retarding Admixture: ASTM C1017, Type II.

G. Steel Casings: All casing shall meet ASTM A283, Grade C; or ASTM A36,
carbon-steel plate, with joints full-penetration welded according to AWS
D1.1, or ASTM A929/A929M, steel sheet, zinc coated corrugated steel. The
Contractor shall design shells to withstand drilling forces and earth
pressures and reinforce the bottom cutting edge as required for proper
drilling and sealing of the shells into the rock. The

cutting edge shall be capable of coring through at least 10 ft of broken or
solid rock. A minimum of 2% out of roundness of the diameter

shall be considered in the design of the shell.
welded and watertight

All seams shall be

H. Concrete Mix: Prepare design mixes according to ACI 211.1 and ACI 301 for each type and strength of concrete determined by either laboratory trial mix or field test data bases. Use a qualified testing agency for preparing and reporting proposed mix designs for laboratory trial mix basis. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 3000 psi.
2. Minimum Slump: Capable of maintaining a slump of 5 inches plus or minus 1 inch.
3. Do not air entrain concrete for caissons
4. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
5. Concrete-mix design adjustments may be considered if characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

Resubmission and approval of proposed changes to concrete-mix proportions is the responsibility of the Contractor.

I. Concrete Mixing: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information. Do not add water to concrete mix after mixing, unless a procedure per ACI 301 is submitted to and approved by the Project Manager. Maintain concrete temperature less than 90 degree Fahrenheit.

PART 3 - EXECUTION

3.1 GENERAL

A. Size: Minimum sizes and types of caissons are shown. Proposal to use caissons of sizes and types different from those shown may be accepted if submitted in writing to Project Manager for approval and provided the following conditions are met:

1. Least dimension of caisson is equal to or greater than least dimension shown.
2. Entire caisson receives full lateral support from surrounding material.

B. Changes: Requests for change in size or type of caisson from those shown shall be accompanied by calculations and other documentation necessary to show that proposed changes will meet load requirements. Do

not proceed with changes before receiving written approval from Project Manager.

C. Temporary Steel Casings: Install casings for protection of workers and inspection personnel, for prevention of cave-ins or displacement of earth walls, and for retention of ground water.

D. Defective Casings: Do not install buckled, distorted or otherwise damaged casings. Replace casings damaged or disturbed during construction, casings that are not mud-tight or otherwise not in accordance with drawings or specifications, at no additional cost to the Government.

E. Survey: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and levels and stake caisson locations.

3.2 EXCAVATION

A. Excavation and construction methods shall result in minimum disturbance of surrounding material and full lateral support of caissons by surrounding material.

B. Remove boulders and rock in caissons such as rock seams underlain with soil seams, sloping rock or rock otherwise unsatisfactory for bearing.

C. If materials with satisfactory bearing strength occur at elevations higher or lower than those shown, place bottom of caissons at higher or lower elevations, subject to approval of Project Manager.

D. Test Drilling: Percussion drill one test hole, 2 inches in diameter to depth equal to twice caisson diameter, but not less than 6 feet deep, in bottom of each caisson which has been excavated to rock to determine if rock seams are underlain by soil seams or voids.

E. Excavate caissons to dimensions and required bearing strata or elevations shown on contract drawings.

Maintain sidewall stability during drilling. Excavate holes for closely spaced caissons, and those occurring in fragile strata, only after adjacent holes are filled with concrete and allowed to set. The excavation shall be accomplished by hand or machine excavation as required. Caisson drilling equipment shall have the minimum torque capacity and downward force capacity for the contract site conditions. Bottoms of caissons shall be cleaned of loose or soft materials and leveled. If bottoms are sloping rock, excavate to a level plane or step with maximum step height less than 1/4 the width or diameter of the bearing area. All material removed

from the caisson holes shall be removed from the ground around the casing before concrete placement is started and shall be disposed of by the Contractor off site in areas submitted to and approved by the Engineer. F. Excavations for utilities, support of excavations, or other purposes shall be kept a minimum distance of two shaft diameters away from the outer edge of the caisson.

3.3 PLACING CONCRETE

A. Before placing concrete, the tip of the caisson shall be observed and approved by a qualified testing agency registered and licensed in the state. The testing agency shall be retained by the Contractor and approved by the Project Manager. The shaft shall be inspected, cleared of mud, water, loose material and debris.

B. Place concrete using a down pipe to direct flow of concrete. Except in presence of water, concrete may fall freely up to a maximum height of 30 feet provided the concrete does not hit the sides of the caisson. Use tremie pipe or pump if distance is greater than 30 feet.

C. Withdraw casings, as concrete is deposited, maintaining top surface of concrete constantly at least 6 feet above lower end of casings. Place concrete to form a monolithic cylindrical shaft having full lateral support from surrounding undisturbed materials. Strike finished top surface of concrete to true plane at required elevation.

D. Concrete placement in each caisson shall be one continuous operation. If placing operation has to be stopped, leave surface approximately level. If concrete has hardened, clean surface and slush with a 1 to 1 cement-sand grout before placing operation is resumed. Concrete pours shall not begin within one hour of darkness. In the event that this type of continuous sequential operation cannot be performed, the Contractor shall submit for approval by the Project Manager a method of securing the open excavation. The Contractor shall not leave excavations open overnight without receiving prior written approval from the Project Manager.

E. When water is present, control water level to within 2 inches of bottom of the caisson by pumping. If impossible or impractical to control water, secure written permission from Project Manager to place concrete through water by means of a watertight tremie.

1. When placing concrete under water, discharge end of tremie shall be submerged in fresh concrete and shaft of tremie maintained full of concrete to point above water level.
2. Increase cement content of concrete required to be placed in water by one sack per cubic yard of concrete.

3.4 CAISSON RECORD

A. For each caisson placed and before superstructure framing is placed, submit to Project Manager for approval a certified report recording following information prepared by Registered Professional Land Surveyor or Registered Civil Engineer.

B. Caisson number, length, and bearing material. C.
Location.

D. Concrete and steel reinforcement properties. E.
Plumbness.

F. Dates:

1. Excavation completed.
2. Concrete placed. G.

Diameters:

1. Top of shaft.
2. Bottom of shaft. H.

Elevations:

1. Top of ground.
2. Top of concrete.
3. Top of bedrock rock.
4. Bottom of caisson.

3.5 CLEAN UP:

A. All debris from excavation of objectionable material, removal of obstructions, and any material not to remain as part of the construction are to be removed and disposed of by the Contractor in a legal manner at no additional cost to the Owner.

B. The site shall be cleaned at frequent intervals and no material shall be stored on the site in a manner, which would obstruct the easy access of equipment and personnel.

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

THIS PAGE INTENTIONALLY LEFT BLANK

Division 32

Exterior Improvements

Division **32**

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 05 23

CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS PART 1 - GENERAL

1.1 DESCRIPTION

A. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:

B. Curb, gutter, and combination curb and gutter wheel stop. C.

Pedestrian Pavement: Walks, wheelchair curb ramps.

D. Vehicular Pavement: driveways.

E. Equipment Pads: Miscellaneous Mechanical and Electrical Equipment Pads

1.2 RELATED WORK

A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subgrade Preparation: Section 31 20 00, EARTH MOVING. C.

Concrete Materials, Quality, Mixing, Design and Other Requirements: Section 03 30 00, CAST-IN-PLACE-CONCRETE.

D. Metal Components of Steps (Railing): Section 05 50 00, METAL FABRICATIONS.

1.3 DESIGN REQUIREMENTS

Design all elements with the latest published version of applicable codes.

1.4 WEATHER LIMITATIONS

Placement of concrete shall be as specified under Article 3.8, COLD WEATHER and Article 3.7, HOT WEATHER of Section 03 30 00, CAST-IN- PLACE CONCRETE.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.

1. Expansion joint filler
2. Hot poured sealing compound
3. Reinforcement
4. Curing materials

C. Data and Test Reports: Select subbase material.

1. Job-mix formula.
2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.

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

M031MM031-07-ULDeformed and Plain Carbon-Steel Bars for
Concrete Reinforcement (ASTM A615/A615M-09) M055MM055-09-ULSteel
Welded Wire Reinforcement, Plain, for

Concrete (ASTM A185)

M147-65-ULMaterials for Aggregate and Soil-Aggregate
Subbase, Base and Surface Courses (R 2004) M148-05-ULLiquid
Membrane-Forming Compounds for Curing

Concrete (ASTM C309)

M171-05-ULSheet Materials for Curing Concrete (ASTM C171) M182-
05-ULBurlap Cloth Made from Jute or Kenaf and Cotton

Mats

M213-01-ULPreformed Expansion Joint Fillers for Concrete
Paving and Structural Construction
(Non-extruding and Resilient Bituminous Type) (ASTM D1751)

M233-86-ULBoiled Linseed Oil Mixer for Treatment of
Portland Cement Concrete

T099-09-ULMoisture-Density Relations of Soils Using a 5.5 lb
Rammer and a 12 in. Drop

T180-09-ULMoisture-Density Relations of Soils Using a 10 lb.
Rammer and an 18 in. Drop

C. American Society for Testing and Materials (ASTM): C94

.....Ready-Mixed Concrete

C143.....Slump of Hydraulic Cement Concrete

PART 2 - PRODUCTS

2.1 GENERAL

Concrete shall be Iowa DOT Section 2301 Type C, air-entrained as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, with the following exceptions:

TYPE	MAXIMUM SLUMP*
Curb	(3")
Pedestrian Pavement	(3")
Vehicular Pavement	(2") (Machine Finished) (4") (Hand Finished)
Equipment Pad	(3" to 4")
* For concrete to be vibrated: Slump as determined by ASTM C143. Tolerances as established by ASTM C94.	

2.2 REINFORCEMENT

- A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.
- B. Welded wire-fabric shall conform to AASHTO M55.
- C. Dowels shall be plain steel bars conforming to AASHTO M31. Tie bars shall be deformed steel bars conforming to AASHTO M31.

2.3 SUBBASE COURSE:

- A. Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag meet Iowa Dot Section 4121.

2.4 FORMS

- A. Use metal or wood forms that are straight and suitable in cross- section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.
- B. Do not use forms if they vary from a straight line more than 1/8 inch in any ten foot long section, in either a horizontal or vertical direction.
- C. Wood forms should be at least 2 inches thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

2.5 CONCRETE CURING MATERIALS

- A. Concrete curing materials shall conform to one of the following:
 - 1. Burlap conforming to AASHTO M182 having a weight of 233 grams (seven ounces) or more per square meter (yard) when dry.
 - 2. Impervious Sheeting conforming to AASHTO M171.
 - 3. Liquid Membrane Curing Compound conforming to AASHTO M148

(ASTM C309), Type 2 and shall be free of paraffin or petroleum.

2.6 EXPANSION JOINT FILLERS

Material shall conform to AASHTO M213.

PART 3 - EXECUTION

3.1 SUBGRADE PENETRATION

A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTH MOVING.

B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SUBBASE COURSE

A. Compact to 98% of materials Std Proctor maximum dry density ASTM D698. B.

Smoothness Test and Thickness Control: Test the completed subbase for grade and cross section with a straight edge.

1. The surface of each layer shall not show any deviations in excess of 3/8 inch.

2. The completed thickness shall be within 1/2 inch of the thickness as shown.

C. Protection:

1. Maintain the finished subbase in a smooth and compacted condition until the concrete has been placed.

2. When Contractor's subsequent operations or adverse weather disturbs the approved compacted subbase, excavate, and reconstruct it with new material meeting the requirements herein specified, at no additional cost to the VA.

3.3 SETTING FORMS

A. Base Support:

1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.

2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.

B. Form Setting:

1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.

2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
 3. Forms shall conform to line and grade with an allowable tolerance of 1/8 inch when checked with a straightedge and shall not deviate from true line by more than 1/4 inch at any point.
 4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
 5. Clean and oil forms each time they are used.
- C. The Contractor's Registered Professional Land Surveyor, specified in Section 00 72 00, GENERAL CONDITIONS, shall establish and control the alignment and the grade elevations of the forms or concrete slipforming machine operations.
1. Make necessary corrections to forms immediately before placing concrete.
 2. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.

3.4 EQUIPMENT

- A. The Project Manager shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.
- B. Maintain equipment and tools in satisfactory working condition at all times.

3.5 PLACING REINFORCEMENT

- A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.
- B. Before the concrete is placed, the Project Manager shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

3.6 PLACING CONCRETE - GENERAL

- A. Obtain approval of the Project Manager before placing concrete. B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the Project Manager before placing concrete.

- C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.
- D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.
- E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.
- F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.
- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

3.7 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

- A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
- B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.
- C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.
- D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
- E. Finish the surface to grade with a wood or metal float.
- F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

3.8 PLACING CONCRETE FOR VEHICULAR PAVEMENT

- A. Deposit concrete into the forms as close as possible to its final position.
- B. Place concrete rapidly and continuously between construction joints.
- C. Strike off concrete and thoroughly consolidate by a finishing machine, vibrating screed, or by hand-finishing.

D. Finish the surface to the elevation and crown as shown.

E. Deposit concrete as near the joints as possible without disturbing them but do not dump onto a joint assembly. Do not place adjacent lanes without approval by the Project Manager.

3.9 CONCRETE FINISHING - GENERAL

A. The sequence of operations, unless otherwise indicated, shall be as follows:

1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
2. Maintain finishing equipment and tools in a clean and approved condition.

3.10 CONCRETE FINISHING CURB AND GUTTER

A. Round the edges of the gutter and top of the curb with an edging tool to a radius of 1/4 inch or as otherwise detailed.

B. Float the surfaces and finish with a smooth wood or metal float until true to grade and section and uniform in textures.

C. Finish the surfaces, while still wet, with a bristle type brush with longitudinal strokes.

D. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the surface, while still wet, in the same manner as the gutter and curb top.

E. Except at grade changes or curves, finished surfaces shall not vary more than 1/8 inch for gutter and 1/4 inch for top and face of curb, when tested with a 10 foot straightedge.

F. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

G. Correct any depressions which will not drain.

H. Visible surfaces and edges of finished curb, shall be free of blemishes, form marks, and tool marks, and shall be uniform in color, shape, and appearance.

3.11 CONCRETE FINISHING PEDESTRIAN PAVEMENT

A. Walks.

1. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.

2. Brooming shall be transverse to the line of traffic.

3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 1/16 inch in depth.
5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 3/16 inch when tested with a 10 foot straightedge.
6. The thickness of the pavement shall not vary more than 1/4 inch.
7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

B. Steps: The method of finishing the steps and the sidewalls is similar to above except as herein noted.

1. Remove the riser forms one at a time, starting with the top riser.
2. After removing the riser form, rub the face of the riser with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Use an outside edger to round the corner of the tread; use an inside edger to finish the corner at the bottom of the riser.
3. Give the risers and sidewall a final brush finish. The treads shall have a final finish with a stiff brush to provide a non-slip surface.
4. The texture of the completed steps shall present a neat and uniform appearance and shall not deviate from a straightedge test more than 3/16 inch.

3.12 CONCRETE FINISHING FOR VEHICULAR PAVEMENT

A. Accomplish longitudinal floating with a longitudinal float not less than 10 feet long and 6 inches wide, properly stiffened to prevent flexing and warping. Operate the float from foot bridges in a sawing motion parallel to the direction in which the pavement is being laid from one side of the pavement to the other, and advancing not more than half the length of the float.

B. After the longitudinal floating is completed, but while the concrete

is still plastic, eliminate minor irregularities in the pavement surfaces by means of metal floats, 5 feet in length, and straightedges, 10 feet in length. Make the final finish with the straightedges, which shall be used to float the entire pavement surface.

C. Test the surface for trueness with a 10 foot straightedge held in successive positions parallel and at right angles to the direction in which the pavement is being laid and the entire area covered as necessary to detect variations. Advance the straightedge along the pavement in successive stages of not more than one half the length of the straightedge. Correct all irregularities and refinish the surface.

D. The finished surface of the pavement shall not vary more than 1/4 inch in both longitudinal and transverse directions when tested with a 10 foot straightedge.

E. The thickness of the pavement shall not vary more than 1/4 inch.

F. When most of the water glaze or sheen has disappeared and before the concrete becomes nonplastic, give the surface of the pavement a broomed finish with an approved fiber broom not less than 18 inches wide. Pull the broom gently over the surface of the pavement from edge to edge. Brooming shall be transverse to the line of traffic and so executed that the corrugations thus produced will be uniform in character and width, and not more than 1/8 inch in depth. Carefully finish the edge of the pavement along forms and at the joints with an edging tool. The brooming shall eliminate the flat surface left by the surface face of the edger.

G. The finish surfaces of new and existing abutting pavements shall coincide at their juncture.

3.13 CONCRETE FINISHING EQUIPMENT PADS

A. After the surface has been struck off and screeded to the proper elevation, give it a smooth dense float finish, free from depressions or irregularities.

B. Carefully finish all slab edges with an edger having a radius as shown in the Drawings.

C. After removing the forms, rub the faces of the pad with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The finish surface of the pad shall not vary more than 1/8 inch when tested with a 10 foot straightedge.

D. Correct irregularities exceeding the above.

3.14 JOINTS - GENERAL

A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.

B. Joints shall be straight and continuous from edge to edge of the pavement.

3.15 CONTRACTION JOINTS

A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.

B. Construct joints in curbs by inserting 1/8 inch steel plates conforming to the cross sections of the curb and gutter.

C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.

D. Finish edges of all joints with an edging tool having the radius as shown.

E. Score pedestrian pavement with a standard grooving tool or jointer.

3.16 EXPANSION JOINTS

A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.

B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.

C. Anchor with approved devices to prevent displacing during placing and finishing operations.

D. Round the edges of joints with an edging tool. E.

Form expansion joints as follows:

1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.

2. Using joint filler of the type, thickness, and width as shown.

3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

3.17 CONSTRUCTION JOINTS

A. Locate longitudinal and transverse construction joints between slabs

of vehicular pavement as shown.

B. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.

C. Use a butt-type joint with dowels in curb and gutter if the joint occurs at the location of a planned joint.

D. Use keyed joints with tiebars if the joint occurs in the middle third of the normal curb and gutter joint interval.

3.18 FORM REMOVAL

A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.

B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

3.19 CURING OF CONCRETE

A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the Project Manager.

B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 6 inches.

C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at least 0.1 mm (4 mils) in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 12 inches. Securely anchor sheeting.

D. Liquid Membrane Curing:

1. Apply pigmented membrane-forming curing compound in two coats at

right angles to each other at a rate of 5 m²/L (200 square feet per gallon) for both coats.

2. Do not allow the concrete to dry before the application of the membrane.
3. Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.
4. Immediately re-spray any area covered with curing compound and damaged during the curing period.

3.20 CLEANING

- A. After completion of the curing period:
1. Remove the curing material (other than liquid membrane).
 2. Sweep the concrete clean.
 3. After removal of all foreign matter from the joints, seal joints as herein specified.
 4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

3.21 PROTECTION

The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Project Manager, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the Project Manager.

3.22 FINAL CLEAN-UP

Remove all debris, rubbish and excess material from the Station.

- - - E N D - -

**SECTION 32 17 23
PAVEMENT MARKINGS**

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work shall consist of furnishing and applying paint on pavement surfaces, in the form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings, in accordance with the details as shown or as prescribed by the Project Manager. Conform to the Manual on Uniform Traffic Control Devices for Streets and Highways, published by the U.S. Department of Transportation, Federal Highway Administration, for details not shown.

1.2 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish Manufacturer's Certificates and Data certifying that the following materials conform to the requirements specified.

B. Paint.

1.3 APPLICABLE PUBLICATIONS

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

B. Federal Specifications (Fed. Spec.):

TT-P-1952DPaint, Traffic Black

C. Master Painters Institute (MPI):

Approved Product List - 2010

PART 2 - PRODUCTS

2.1 PAINT

A. Paint for marking pavement (parking lot and zone marking) shall conform to MPI No. 97, color as shown. Paint for obliterating existing markings shall conform to Fed. Spec. TT-P-1952D. Paint shall be in containers of at least 18 L (5 gallons). A certificate shall accompany each batch of paint stating compliance with the applicable publication.

2.2 PAINT APPLICATOR

Apply all marking by approved mechanical equipment. The equipment shall provide constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in the case of skip lines. The equipment shall have manual control to apply continuous lines of varying length and marking widths as shown. Provide pneumatic spray guns for hand

application of paint in areas where a mobile paint applicator cannot be used. An experienced technician that is thoroughly familiar with equipment, materials, and marking layouts shall control all painting equipment and operations.

2.3 SANDBLASTING EQUIPMENT

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall furnish not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Thoroughly clean all surfaces to be marked before application of paint.

Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by the Project Manager. The application of paint conforming to Fed. Spec. TT-P-1952D is an option to removal

of existing paint markings on asphalt pavement. Apply the black paint in as many coats as necessary to completely obliterate the existing markings. Where oil or grease are present on old pavements to be marked, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint. Pavement marking shall follow as closely as practicable after the surface has been cleaned and dried, but do not begin any marking until the Project Manager has inspected the surface and gives permission to proceed. The Contractor shall establish control points for marking and provide templates to control paint application by type and color at necessary intervals. The Contractor is responsible to preserve and apply marking in conformance with the established control points.

3.2 APPLICATION

- A. Apply uniformly painted pavement marking of required color(s), length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces in conformance with the details as shown and

established control points. The length and width of lines shall conform within a tolerance of plus or minus 3 inches and plus or minus 1/8 inch, respectively, in the case of skip markings. The length of intervals shall not exceed the line length tolerance. Temperature of the surface to be painted and the atmosphere shall be above 50 F and less than 95 F. Apply the paint at a wet film thickness of 0.015 inch. Apply paint in one coat. At the direction of the Project Manager, markings showing light spots may receive additional coats. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic. If there is a deficiency in drying of the marking, discontinue paint operations until cause of the slow drying is determined and corrected. Remove and replace marking that is applied at less than minimum material rates; deviates from true alignment; exceeds stipulated length and width tolerances; or shows light spots, smears, or other deficiencies or irregularities. Use carefully controlled sand blasting, approved grinding equipment, or other approved method to remove marking so that the surface to which the marking was applied will not be damaged.

3.3 PROTECTION

A. Conduct operations in such a manner that necessary traffic can move without hindrance. Protect the newly painted markings so that, insofar as possible, the tires of passing vehicles will not pick up paint. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic. Efface and replace damaged portions of markings at no additional cost to the Government.

3.4 DETAIL PAVEMENT MARKING

A. Use Detail Pavement Markings, exclusive of actual traffic lane marking, at exit and entrance islands and turnouts, on curbs, at crosswalks, at parking bays, and at such other locations as shown. Show the International Handicapped Symbol at indicated parking spaces. Color shall be as shown. Apply paint for the symbol using a suitable template that will provide a pavement marking with true, sharp edges and ends. Place detail pavement markings of the color(s), width(s) and length(s), and design pattern at the locations shown.

3.5 TEMPORARY PAVEMENT MARKING

When shown or directed by the Project Manager, apply Temporary Pavement Markings of the color(s), width(s) and length(s) shown or directed.

After the temporary marking has served its purpose and when so ordered by the Project Manager, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that the surface to which the marking was applied will not be damaged. As an option, an approved preformed pressure sensitive, adhesive tape type of temporary pavement marking of the required color(s), width(s) and length(s) may be furnished and used in lieu of temporary painted marking. The Contractor shall be fully responsible for the continued durability and effectiveness of such marking during the period for which its use is required. Remove any unsatisfactory tape type marking and replace with painted markings at no additional cost to the Government.

3.6 FINAL CLEAN-UP

Remove all debris, rubbish and excess material from the Station.

- - - E N D - - -

SECTION 32 90 00
PLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this section consists of furnishing and installing plant, soils, edging turf, grasses and landscape materials required as specified in locations shown.

1.2 RELATED WORK

A. Topsoil Testing: Section 01 45 29, TESTING LABORATORY SERVICES. B. Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
C. Stripping Topsoil, Stock Piling and Topsoil Materials: Section 31 20 00, EARTH MOVING.

1.3 DEFINITIONS

A. Backfill: The earth used to replace earth in an excavation.
B. Balled and Burlapped Stock: ANSI Z60.1. Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball.
C. Balled and Potted Stock: ANSI Z60.1. Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
F. Finish Grade: Elevation of finished surface of planting soil.

G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

I. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

J. Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, turf and grasses, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

K. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

L. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

M. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.4 DELIVERY, STORAGE AND HANDLING

A. Notify the Project Manager of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant and landscape materials from the job site immediately.

B. Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Keep seed and other packaged materials in dry storage away from contaminants.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants. Keep bulk materials in dry storage away from contaminants.
2. Provide erosion control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers lime and soil amendments with appropriate certificates.
- D. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
- E. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- F. Handle planting stock by root ball.
- G. The use of equipment such as "tree spades" is permitted provided the plant balls are sized in accordance with ANSI Z60.1 and tops are protected from damage.
- H. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
- I. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than 6 hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Heel-in bare-root stock: Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet, condition.

J. Harvest, deliver, store, and handle sod according to requirements in TPI's "Guideline Specifications to Turfgrass Sodding". Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage, seed contamination and drying.

K. Deliver sprigs in air tight bags to keep from drying out. Sprigs delivered unwrapped, shall be kept moist in burlap or other accepted material until planting.

L. Deliver plugs within 24 hours of harvesting, keep moist until planting.

M. All pesticides and herbicides shall be properly labeled and registered with the U.S. Department of Agriculture. Deliver materials in original, unopened containers showing, certified analysis, name and address of manufacturer, product label, manufacturer's application instructions specific to the project and indication of conformance with state and federal laws, as applicable.

1.5 PROJECT CONDITIONS

A. Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion. Plant during one of the following periods:

1. Spring Planting: April to June.

2. Fall Planting: September 1 to November 1.

C. Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

D. Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.6 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association with 3 years experience in landscape installation.

2. Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

3. Installer's personnel assigned to the Work shall have certification in all of the following categories from the Professional Landcare Network and submit one copy of certificate to the Project Manager: a. Certified Landscape

Technician (CLT) - Exterior, with

installation, maintenance specialty area(s), designated CLT- Exterior.

b. Certified Ornamental Landscape Professional, designated COLP.

4. Pesticide Applicator: Licensed in state of project, commercial.

C. A qualified Arborist shall be licensed and required to submit one copy of license to the Project Manager.

D. Include an independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

E. For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic

matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60, "Diagnosis and Improvement of Saline and Alkali Soils".

2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Project Manager. A minimum of 3 representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.

3. Report suitability of tested soil for plant growth.

a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd (0.76 cu. m) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action. F. Provide quality, size, genus, species, variety and sources of plants indicated, complying with applicable requirements in ANSI Z60.1.

G. Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Measure trees and shrubs with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4 inch caliper size, and 12 inches above the root flare for larger sizes.

2. Measure other plants with stems, petioles, and foliage in their normal position.

H. Project Manager may observe plant material either at place of growth or at site before planting for compliance with requirements for genus,

species, variety, cultivar, size, and quality. Project Manager retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Project Manager of plant material sources seven days in advance of delivery to site.

I. Include product label and manufacturer's literature and data for pesticides and herbicides.

J. Conduct a pre-installation conference at Project site.

1.7 SUBMITTALS

A. Submit product data for each type of product indicated, including soils:

1. Include quantities, sizes, quality, and sources for plant materials.

2. Include EPA approved product label, MSDS (Material Safety Data Sheet) and manufacturer's application instructions specific to the Project.

3. Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of 3 photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Submit samples and manufacturer's literature for each of the following for approval before work is started.

1. Trees and Shrubs: 1 sample of each variety and size. Maintain approved samples on-site as a standard for comparison.

2. Organic and Compost Mulch: 1 quart (1-liter) volume of each organic and compost mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

3. Mineral Mulch: 2 lb (1.0 kg) of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.

a. Weed Control Barrier: 12 by 12 inches.

4. Submit edging materials and accessories in manufacturer's standard size, to verify color selected.

5. Erosion Control Materials: 12 by 12 inches.

6. Root Barrier: Width of panel by 12 inches.

7. Landscape Membranes: 12 by 12 inches.

8. Tree Wrap: Width of panel by 12 inches.

C. Qualification data for qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

D. Prior to delivery, provide notarized certificates attesting that each type of manufactured product, from the manufacturer, meet the requirements specified and shall be submitted to the Project Manager for approval:

1. Plant Materials (Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease).

2. Seed and Turf Materials notarized certificate of product analysis.

3. Manufacturer's certified analysis of standard products.

4. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

E. Material Test Reports: For standardized ASTM D5268 topsoil, existing native surface topsoil, existing in-place surface soil and imported or manufactured topsoil.

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

1.8 PLANT AND TURF ESTABLISHMENT PERIOD

A. The establishment period for plants and turf shall begin immediately after installation, with the approval of the Project Manager, and continue until the date that the Government accepts the project or phase for beneficial use and occupancy. During the Establishment Period the Contractor shall maintain the plants and turf as required in Part 3.

1.9 PLANT AND TURF MAINTENANCE SERVICE

A. Provide initial maintenance service for trees, shrubs, ground cover and other plants by skilled employees of landscape Installer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period: 12 months from date of Substantial Completion. B. Obtain continuing maintenance proposal from Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.10 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute (ANSI):

Z60.1-04.....Nursery Stock

C. Association of Official Seed Analysts (AOSA): Rules for Testing Seed. D. American Society For Testing And Materials (ASTM):

C33/C33M-11.....Concrete Aggregates

C136-06.....Sieve Analysis of Fine and Coarse Aggregates C516-

08.....Vermiculite Loose Fill Thermal Insulation C549-

06.....Perlite Loose Fill Insulation

C602-07.....Agricultural Liming Materials

D5268-07.....Topsoil Used for Landscaping Purposes

E. Hortus Third: A Concise Dictionary of Plants Cultivated in the United States and Canada.

F. Turfgrass Producers International (TPI): Guideline Specifications to Turfgrass Sodding.

G. United States Department of Agriculture (USDA): Handbook No. 60
Diagnosis and Improvement of Saline and Alkali Soils; Federal Seed Act Regulations.

1.11 WARRANTY

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance, unless noted otherwise below. Further, the Contractor will provide all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

1. Plant and Turf Warranty Periods will begin from the date of Substantial Completion.

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.

b. Ground Covers, Biennials, Perennials, Turf, and Other Plants: 6 months.

c. Annuals: 3 months.

2. The Contractor shall have completed, located, and installed all plants and turf according to the plans and specifications. All plants and turf are expected to be living and in a healthy condition at the time of final inspection.

3. The Contractor will replace any dead plant material and any areas void of turf immediately, unless required to plant in the succeeding planting season. Provide extended warranty for period equal to original warranty period for replacement plant materials. Replacement plant and turf warranty will begin on the day the work is completed.

4. Replacement of relocated plants, that the Contractor did not supply, is not required unless plant failure is due to improper handling and care during transplanting. Loss through Contractor negligence requires replacement in plant type and size.

5. The Government will reinspect all plants and turf at the end of the Warranty Period. The Contractor will replace any dead, missing, or defective plant material and turf immediately. The Warranty Period

will end on the date of this inspection provided the Contractor has complied with the warranty work required by this specification. The Contractor shall also comply with the following requirements:

- a. Replace plants that are more than 25 percent dead, missing or defective plant material prior to final inspection.
 - b. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 - c. Mulch and weed plant beds and saucers. Just prior to final inspection, treat these areas to a second application of approved pre-emergent herbicide.
 - d. Complete remedial measures directed by the Project Manager to ensure plant and turf survival.
 - e. Repair damage caused while making plant or turf replacements.
- B. Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. Plant and turf materials: ANSI Z60.1; will conform to the varieties specified and be true to botanical name as listed in Hortus Third; nursery-grown plants and turf material true to genus, species, variety, cultivar, stem form, shearing, and other features indicated on Drawings; healthy, normal and unbroken root systems developed by transplanting or root pruning; well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf; free of disease, pests, eggs, larvae, and defects such as knots, sun scald, windburn, injuries, abrasions, and disfigurement.

1. Trees-deciduous and evergreen: Single trunked with a single leader, unless otherwise indicated; symmetrically developed deciduous trees and shrubs of uniform habit of growth; straight boles or stems; free from objectionable disfigurements; evergreen trees and shrubs with well developed symmetrical tops, with typical spread of branches for each particular species or variety. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
2. Ground cover and vine plants: Provide the number and length of runners for the size specified on the Drawings, together with the proper age for the grade of plants specified. Provide vines and ground cover plants well established in removable containers, integral containers, or formed homogeneous soil sections. Plants shall have been grown under climatic conditions similar to those in the locality of the project. Spray all plants budding into leaf or having soft growth with an anti desiccant at the nursery before digging.
3. The minimum acceptable sizes of all plants, measured before pruning with branches in normal position, shall conform to the measurements designated. Plants larger in size than specified may be used with the approval of the Project Manager, with no change in the contract price. When larger plants are used, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.
4. Provide nursery grown plant material conforming to the requirements and recommendations of ANSI Z60.1. Dig and prepare plants for shipment in a manner that will not cause damage to branches, shape, and future development after planting.
5. Balled and burlapped (B&B) plant ball sizes and ratios will conform to ANSI Z60.1, consisting of firm, natural balls of soil wrapped firmly with burlap or strong cloth and tied.
6. Bare root (BR) plants shall have the root system substantially intact, but with the earth carefully removed. Cover roots with a thick coating of mud by "puddling" after the plants are dug.

7. Container grown plants shall have sufficient root growth to hold the earth intact when removed from containers, but shall not be root bound.

8. Make substitutions only when a plant (or alternates as specified) is not obtainable and the Project Manager authorizes a change order providing for use of the nearest equivalent obtainable size or variety of plant with the same essential characteristics and an equitable adjustment of the contract price.

9. Existing plants to be relocated, ball sizes shall conform to requirements for collected plants in ANSI Z60.1, and plants shall be dug, handled, and replanted in accordance with applicable sections of these specifications.

10. Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Label at least one plant of each variety, size, and caliper with a securely attached, waterproof and weather-resistant label bearing legible the correct designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as indicated in the Plant Schedule or Plant Legend shown on the Drawings. Labels shall be securely attached and not be removed.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.

2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.

3. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: ASTM C549, horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Coarse Sand shall be concrete sand, ASTM C33 Fine Aggregate, clean, sharp free of limestone, shale and slate particles, and toxic materials. H. Vermiculite: ASTM C516, horticultural grade and free of any toxic materials.

I. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Organic matter: Commercially prepared compost. Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2 inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

B. Peat: A natural product of peat moss derived from a fresh-water site, except as otherwise specified. Peat shall be shredded and granulated to pass through a 1/2 inch mesh screen with a pH range of 3.4 to 4.8 and conditioned in storage piles for at least 6 months after excavation.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 PLANT AND TURF FERTILIZERS

A. Soil Test: Evaluate existing soil conditions and requirements prior to fertilizer selection and application to minimize the use of all fertilizers and chemical products. Obtain approval of Project Manager for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions prior to application. Apply products during favorable weather and site conditions according to manufacturer's written instructions and warranty requirements. Fertilizers to be registered and approved by EPA,

acceptable to authorities having jurisdiction, and of type recommended by manufacturer applicable to specific areas as required for Project conditions and application. Provide commercial grade plant and turf fertilizers, free flowing, uniform in composition and conforms to applicable state and federal regulations.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition shall be nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

C. Slow-Release Fertilizer: Granular or pellet fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition shall be nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Plant Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 10-gram tablets.

2. Nutrient Composition shall be 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.5 PLANTING SOILS

A. Planting Soil: ASTM D5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D5268 topsoil with the following soil amendments and fertilizers as recommended by the soils analysis.

B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with another specified planting soil when quantities are insufficient.

2. Mix existing, native surface topsoil with the following soil amendments and fertilizers as recommended by the soils analysis.

C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources can be used if sufficient topsoil is not available on site to meet the depth as specified herein. The Contractor shall furnish imported topsoil. At least 10 days prior to topsoil delivery, notify the Project Manager of the source(s) from which topsoil is to be furnished. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

2.6 BIOSTIMULANTS

A. Biostimulants: Contain soil conditioners, VAM fungi, and endomycorrhizal and ectomycorrhizal fungi spores and soil bacteria appropriate for existing soil conditions.

2.7 LANDSCAPE MEMBRANES

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101 g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally- encountered chemicals, alkalis, and acids.

B. Composite Fabric shall be woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd. (162 g/sq. m).

2.8 MULCH

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood, ground or shredded bark, wood and bark chips, pine straw.

a. Straw for lawn seed bed mulch: Stalks from oats, wheat, rye, barley, or rice that are free from noxious weeds, mold or other objectionable material. Straw shall be in an air dry condition and suitable for placing with blower equipment.

b. Wood cellulose fiber for use with hydraulic application of grass seed and fertilizer: Consist of specially prepared wood cellulose fiber, processed to contain no growth or germination inhibiting factors, and dyed an appropriate color to facilitate visual

metering of the application of materials. On an air dry weight basis, the wood cellulose fiber shall contain a maximum of 12 percent moisture, plus or minus 3 percent at the time of manufacture. The pH range shall be from 3.5 to 5.0. The wood cellulose fiber shall be manufactured so that:

- 1) After addition and agitation in slurry tanks with fertilizers, grass seeds, water, and other approved additives, the fibers in the material will become uniformly suspended to form an homogeneous slurry.
- 2) When hydraulically sprayed on the ground, the material will form a blotter like cover impregnated uniformly with grass seed.
- 3) The cover will allow the absorption of moisture and allow rainfall or applied water to percolate to the underlying soil.

2. Size Range shall be 2 inches maximum.

3. Color shall be natural.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1 inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- C. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:

1. Type: Rounded riverbed gravel or smooth-faced stone.
2. Size Range: 1-1/2 inches maximum, 3/4 inch minimum in accordance with ASTM C136.
3. Color: Readily available natural gravel color range.

2.9 TACKIFIERS AND ADHESIVES

A. Nonasphalt tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

B. Asphalt emulsion: ASTM D977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.10 EROSION CONTROL

A. Erosion control blankets: Biodegradable wood excelsior, straw, or coconut fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended biodegradable staples, 6 inches long.

B. Erosion control fiber mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended biodegradable staples, 6 inches long.

C. Erosion control mats: Cellular, non-biodegradable slope stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3 inch nominal mat thickness. Include manufacturer's recommended biodegradable anchorage system for slope conditions.

2.11 EDGING

A. Aluminum edging: ASTM B221, Alloy 6063-T6, standard profile extruded aluminum edging, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.

1. Edging Size: 1/8 inch wide by 5-1/2 inches deep.

2. Stakes: Aluminum, ASTM B221, Alloy 6061-T6, approximately 1-1/2 inches wide by 12 inches long.

3. Finish: Black anodized.

4. Paint color shall be Black.

B. Natural cut edging shall edge plant beds with an excavated „V“ cut to provide a clear division line between the plant bed and adjacent turf. Do not use any artificial or manufactured products to form plant bed edges.

2.12 WATER

A. Water shall not contain elements toxic to plant life. Water to be obtained from on site at no cost to the Contractor.

2.13 ANTIDESICCANT

A. Antidesiccant: An emulsion specifically manufactured for agricultural use that will provide a protective film over plant surfaces permeable enough to permit transpiration.

2.14 TURF SELECTIONS

A. Grasses for Cool Regions shall be:

1. Bluegrasses: Kentucky (Poa pratensis).

2. Fescue: Red (Festuca rubra).

3. Ryegrasses: Perennial (*Lolium perenne*)

2.15 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with "AOSA, Rules for Testing Seed" for purity and germination tolerances. Seed shall be labeled in conformance with U. S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will not be acceptable.

B. Seed Species: Not less than 80 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed.

Type (1) Lawn Mixture

Type of Seed	Application Rate lb/acre
Kentucky Bluegrass Cultivar	40
Kentucky Bluegrass Cultivar (not same variety as above)	40
Kentucky Bluegrass Cultivar	40
Creeping Red Fescue	15
Certified Fine Leafed Perennial Ryegrass Cultivar	15
Certified Fine Leafed Perennial Ryegrass Cultivar (not same variety as above)	15
TOTAL 165.0	

2.16 SOD

A. Sod: Approved Including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding". Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Sod Species: Grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

Permitted Kentucky Bluegrass Cultivars

Ram I Liberty
Midnight Meret
Bubblue Nustar
Apex Eclipse
Glade America
Rugby II
NuGlade
Quantrum Dragon
Dellwood Blue
Chip Absolute
Award

2.17 PESTICIDES

A. Consider IPM (Integrated Pest Management) practices to minimize the use of all pesticides and chemical products. Obtain approval of Chief Engineer for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions prior to application. Apply products during favorable weather and site conditions according to manufacturer's written instructions and warranty requirements. Pesticides to be registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
 5. Special conditions may exist that warrant a variance in the specified planting dates or conditions. Submit a written request to the Project Manager stating the special conditions and proposal variance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Project Manager and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion control measures to prevent erosion or displacement of soils and discharge of soil bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain approval by the Project Manager of layout before excavating or planting. The Project Manager may approve adjustments to plant material locations to meet field conditions.

D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.3 PLANTING AREA ESTABLISHMENT

A. Loosen subgrade of planting areas to a minimum depth of 12 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.

a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

b. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Before planting, obtain Project Manager's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45 degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately 3 times as wide as ball diameter for balled and burlapped balled and potted container-grown stock.
 2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 6. Maintain supervision of excavations during working hours.
 7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
 8. Use topsoil to form earth saucers or water basins for watering around plants. Basins to be 2 inches high for shrubs and 4 inches high for trees.
- B. Subsoil and topsoil removed from excavations may be used as planting soil.
- C. Notify Project Manager if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- D. Notify Project Manager if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow water to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Prior to planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Use planting soil for backfill.
 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half full, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil- testing laboratory. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Set balled and potted container-grown stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Use planting soil for backfill.
2. Carefully remove root ball from container without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half full, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil- testing laboratory. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Set and support bare-root stock in center of planting pit or trench with root flare 2 inches above adjacent finish grade.

1. Use planting soil for backfill.

2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.

3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.

4. Continue backfilling process. Water again after placing and tamping final layer of soil.

F. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 MECHANIZED TREE SPADE PLANTING

A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

C. Cut exposed roots cleanly during transplanting operations.

D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.

E. Where possible, orient the tree in the same direction as in its original location.

3.7 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Project Manager, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

C. Do not apply pruning paint to wounds.

3.8 ROOT-BARRIER INSTALLATION

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings.

B. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.

1. Position top of root barrier per manufacturer's recommendations.

2. Overlap root barrier a minimum of 12 inches at joints.

3. Do not distort or bend root barrier during construction activities.

4. Do not install root barrier surrounding the root ball of tree.

3.9 GROUND COVER AND PLANT INSTALLATION

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

H. Plant ground cover in areas to receive erosion control materials through the material after erosion control materials are in place.

3.10 MULCH INSTALLATION

A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 12 inches and secure seams with galvanized pins.

B. Mulch backfilled surfaces of planting areas and other areas indicated.

Keep mulch out of plant crowns and off buildings, pavements, utility standards/pedestals, and other structures.

1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3 inch average thickness, with 36 inch radius around trunks or stems. Do not place mulch within 6 inches of trunks or stems.

2. Organic Mulch in Planting Areas: Apply 3 inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

3.11 EDGING INSTALLATION

A. Install aluminum edging where indicated according to manufacturer's written instructions. Anchor with aluminum stakes spaced approximately 48 inches apart, driven below top elevation of edging.

3.12 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring plant saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use IPM (Integrated Pest Management) practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such

as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.13 TURF AREA PREPARATION AND GRADING

A. For newly graded subgrades loosen subgrade to a minimum depth of 8 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.

B. Finish grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

3.14 PREPARATION FOR EROSION-CONTROL MATERIALS.

A. Prepare area as specified in "Turf Area Preparation and Grading" Article.

B. For erosion control mats, install planting soil in two lifts, with second lift equal to thickness of erosion control mats. Install erosion control mat and fasten with biodegradable materials as recommended by material manufacturer.

C. Fill cells of erosion control mat with planting soil and compact before planting.

D. For erosion control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten with biodegradable materials as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.15 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 165 lb/ac.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and fastened with biodegradable materials according to manufacturer's written instructions.

E. Protect seeded areas with erosion control mats where shown on Drawings; install and anchor with biodegradable materials according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre sq. m) to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. (38 to 49 L/92.9 sq. m). Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch or planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.16 HYDROSEEDING

A. For hydroseeding, mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with manufacturer's recommended tackifier.

2. Apply slurry uniformly to all areas to be seeded in a one-step process.

Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.17 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with biodegradable staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently until sod is established.

3.18 TURF RENOVATION

A. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

D. Mow, dethatch, core aerate, and rake existing turf.

E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

I. Apply seed and protect with straw mulch sod as required for new turf.

J. Water newly planted areas and keep moist until new turf is established.

3.19 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.

2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use IPM (Integrated Pest Management) practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow to a height of 2 to 3 inches.

3.20 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Project Manager:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches.
 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
 3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
 4. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.21 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Project Manager before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Non-Selective): Applied to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Non-Selective): Applied only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.22 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

D. Erect temporary fencing or barricades and warning signs, as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

E. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

F. Remove nondegradable erosion control measures after grass establishment period.

G. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

-

- - END - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

THIS PAGE INTENTIONALLY LEFT BLANK

Division 33

Utilities

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 10 00

WATER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Underground water distribution system complete, ready for operation, including all appurtenant structures, and connections to both new building service lines and to existing water supply.

1.2 RELATED WORK:

A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.

B. Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: Section 31 20 00, EARTH MOVING.

C. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.

D. Protection of materials and equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 DEFINITIONS:

A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout building areas and other areas of water use, including hydrants, valves, and other appurtenances used to supply water for domestic and fire-fighting/fire protection purposes.

B. Water Service Line: Pipe line connecting building piping to water distribution lines.

1.4 QUALITY ASSURANCE:

A. Products Criteria:

1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be product of one manufacturer.

2. Nameplate: Nameplate bearing manufacturer's name or identifiable trademark 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.

B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Water lines and the extension, and/or modifications to Public Utility systems.

C. Comply with all rules and regulations of Federal, State, and Local having jurisdiction over the design, construction, and operation of

potable water systems.

D. All material surfaces in contact with potable water shall comply with NSF 61.

1.5 SUBMITTALS:

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

B. Manufacturers' Literature and Data (Submit all items as one package):
(Ductile Iron Pipe and Polyvinyl Chloride (PVC) shall be in accordance with AWWA C600 and C605 respectively; and shall be provided to Project Manager for approval.)

1. Piping.
2. Gaskets.
3. Valves.
4. Fire hydrants.
5. Steps.
6. Valve boxes.
7. Joint restraint.
8. Disinfection products.
9. Link/sleeve seals.

C. Testing Certifications:

1. Certification of Backflow Devices.
2. Hydrostatic Testing.
3. Certification of Disinfection, including free chlorine residuals, and bacteriological examinations.

1.6 APPLICABLE PUBLICATIONS:

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

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

A123-97Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products

A148M-03Standard Specifications for Steel Castings

A242-00Standard Specifications for High Strength Low
Alloy Structural Steel AASHTO No. M161

A307-02Standard Specifications for Carbon Steel Bolts and
Studs, 60,000 psi Tensile Strength

A536-04Standard Specifications for Ductile Iron

Castings

D1784-03Standard Specifications for Rigid PVC Compounds and CPVC Compounds

D2464-99Standard Specifications for Threaded PVC Pipe Fittings, Schedule 80.

D2467-02Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

D3139-98Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

F477-02e1Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association

AWWA): B300-04.....Hypochlorites B301-04 Liquid Chlorine

C104-04Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water

C105-99Polyethylene Encasement for Gray and Ductile C.I. Piping for Water

C110-03Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches for Water

C111-01Rubber-Gasket Joints for Ductile-Iron and Gray- Iron Pressure Pipe and Fittings

C115-99Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges

C150-02American National Standard for Thickness Design of Ductile Iron Pipe

C151-96Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water

C153-00Ductile-Iron Compact Fittings, 3 inches Through 12 Inches for Water

C500-02Gate Valves for Water and Sewerage Systems

C502a-95Dry-Barrel Fire Hydrants

C509-01Resilient Seated Gate Valve for Water

C550-01Protective Epoxy Interior Coatings for Valves and Hydrants

C600-01Installation for Ductile-Iron Water Mains and Their Appurtenances

- C605-94Underground Installation of Polyvinyl Chloride
(PVC) Pressure Pipe and Fittings for Water
- C651-92Disinfecting Water Mains
- C800-01Underground Service Line Valves and Fittings
- C900-97Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches
Thru 12 Inches, for Water
- D. National Fire Protection Association (NFPA):
- 24-95Installation of Private Fire Service Mains and
Their Appurtenances
- 291-01Fire Flow Testing and Marking of Hydrants
- 1141-98Fire Protection in Planned Building Groups
- E. NSF International:
- 14-03Plastics Piping Components and Related Materials
- 61-02Drinking Water System Components-Health Effects
(Sections 1-
- F. Foundation for Cross-Connection Control and Hydraulic Research-2005

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS:

A. Ductile iron pipe, direct buried:

1. Provide ductile iron pipe conforming to the requirements of AWWA C151, Pressure Class 350 for Pipe 4 inches through 12 inches) in diameter with standard thickness cement mortar lining interior, and interior asphaltic seal coat and exterior asphaltic coating, in accordance with AWWA and ANSI Standards.
2. Below Grade: Supply pipe in lengths not in excess of a nominal 20 feet with rubber ring type push-on joints, mechanical joint or approved restrained joint. Provide flange joint pipe where shown on the drawings. Provide mechanical and restrained joint pipe with sufficient quantities of accessories as required for each joint.
3. When a polyethylene encasement over pipe, fittings, and valves is a requirement as indicated on the drawings, the material, installation and workmanship shall conform to applicable sections of AWWA C105. Make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfill following installation without delay to avoid exposure to sunlight.

B. Ductile Iron Pipe Above Grade or in Below Ground Concrete Pits:

1. Flanged ductile iron pipe, AWWA C115, with factory applied screwed

long hub flanges except as otherwise specified hereinafter. Face and drill flanges after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and flush with end of pipe, ANSI B16.1, 125 psi/250 psi standard, for the purpose intended.

2. Wall Sleeve Castings: Size and types shown on the drawings and be hot dipped galvanized. Seal strips, where required shall be Link Seal as manufactured by Thunderline Corp., Wayne, Michigan or equal.

3. Pipe Thickness Class: Minimum of Class 53 as defined in AWWA C150 for all sizes of flanged pipe.

4. Rubber Ring Gaskets: Full face type, AWWA C111, 1/16 inch rubber ring gaskets and of approved composition suitable for the required service.

5. Pipe and fittings exposed to view in the finished work are to be painted in accordance with Section 09 91 00, PAINTING. Pipe shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Kop-Coat No. 621 Rust Inhibitive Primer or equal. Paint color shall match the wall color.

6. Bolts and Nuts on Flanged Fittings: Grade B, ASTM A307. Low alloy, high strength steel in accordance with AWWA C111. Assemble stainless steel bolts and nuts using anti-seize compound to prevent galling.

C. All Pipe Fittings: Ductile iron with a minimum pressure rating of 350 psi. Fittings shall meet the requirements of ANSI and AWWA specifications as applicable. Rubber gasket joints shall conform to AWWA C111 for mechanical and push-on type joints. Ball joints shall conform to AWWA C151 with a separately cast ductile iron bell conforming to ASTM A148. Flanged fittings shall conform to AWWA C115 and be furnished flat faced and drilled to 125 psi or 250 psi template in accordance with ANSI B16.1 with full faced gaskets.

D. Provide cement mortar lining and bituminous seal coat on the inside of the pipe and fittings in accordance with AWWA C104. Provide standard asphaltic coating on the exterior.

E. Provide a factory hydrostatic test of not less than 500 psi for all pipe in accordance with AWWA C151.

F. Provide non-detectable adhesive backed identification tape on top and sides of all buried ductile iron pipe, extended from joint to joint along the length of the pipe and have black lettering identifying the

pipe service at no more than 12 inch intervals. According to service, the tape background color shall be as follows: potable water-blue.

2.2 POLYVINYL CHLORIDE PIPE AND FITTINGS:

A. Class-Rated Polyvinyl Chloride (PVC) Pipe:

1. PVC pipe and accessories 4 inches-14 inches in diameter, AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe", Class 200, DR 14, cast iron outside diameters, unless otherwise shown or specified.
2. PVC Pipe and Accessories Smaller than 4 inches: Schedule 80, meeting the requirements of ASTM D-1785, Type 1, Grade 1. All exposed piping shall be CPVC meeting requirements of ASTM F441.

B. Joints:

1. Pipe 3 inches and Greater in Diameter: Push-on type with factory installed solid cross section elastomeric ring meeting the requirements of ASTM F-477.
2. Pipe Less Than 3 inches in Diameter: Threaded (ASTM D-2464) or solvent welded (ASTM 2467). Use Teflon tape or liquid Teflon thread lubricant approved for use on plastic on all threaded joints.

C. Fittings:

1. Class-Rated Pipe 3 inches in Diameter and Greater: Ductile iron with mechanical joints conforming to the requirements of AWWA C153.
2. For Schedule 80 Pipe less than 3 inches in Diameter: Threaded or solvent weld. Threaded PVC fittings shall conform to ASTM D2464. CPVC fittings shall conform to ASTM F437 for threaded fittings and ASTM F439 for solvent weld fittings.

2.3 VALVES:

A. Asbestos packing is not allowed. B.

Gate:

1. 75 mm (3 inches) and Larger: Resilient seated, ductile iron body, bronze mounted, inclined seats, non-rising stem type turning counter- clockwise to open, 200 pound WOG. AWWA C509. The resilient seat shall be fastened to the gate with stainless steel fasteners or vulcanizing methods. The interior and exterior shall be coated with thermo- setting or fusion epoxy coating in accordance with AWWA C550.

2. Operator:

- a. Underground: Except for use with post indicators, furnish valves with 2 inch nut for socket wrench operation. Post indicator shall

comply with the requirements of NFPA 24 and shall be fully compatible with the valve provided.

b. Above Ground and in Pits: Hand wheels.

3. Joints: Ends of valves shall accommodate, or be adapted to, pipe installed.

2.4 VALVE BOX:

Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 3/16 inch. Box shall be adapted, without full extension, to depth of cover required over pipe at valve location. Cast the word "WATER" in cover. Provide 2 "T" handle socket wrenches of 5/8 inch round stock long enough to extend 2 feet above top of deepest valve box.

2.5 POST INDICATOR VALVE:

A. Valve: Valve shall conform to the specifications listed in Section 2.4 for gate valves. The Post Indicator shall conform to NFPA 24, and shall be fully compatible with the valve and all the supervisory switches.

2.6 FIRE HYDRANTS:

A. Size of main valve opening of each hydrant shall be 5 inches, minimum. Hose thread, size of fire apparatus connection, and shape, size and direction of rotation of operating head of hydrant shall be identical with those in use at station.

B. Hydrant shall be type AWWA C502, heavy construction, of proper length to connect pipe without extra fittings, and shall be the traffic type with safety flange on barrel and safety couplings on the valve stem with the following features:

1. Interior removable without digging up hydrant; can be packed under pressure; 6 inch bell connection; one steamer nozzle and two hose nozzles with nozzle caps securely chained to barrel; suitable drainage device; single rubber or leather-faced valve in base; nozzles, stuffing boxes, wedge nuts, seat rings, clamp plates, etc. Threaded joints or spindles shall be bronze. Upper and lower barrels shall be of equal diameters. Upper barrel shall be of sufficient length to permit setting hydrant with barrel flange not more than 2 inches above finished grade. All fire hydrants shall have 6 inch bottom connection.
2. Provide fire hydrants with a finish paint identical to the existing fire hydrants.

C. Provide 2 wrenches with handles not less than 14 inches long.

2.7 PIPE SLEEVES:

A. Ductile iron or zinc coated steel.

2.8 FLEXIBLE EXPANSION JOINTS: (PROVIDE FOR DOMESTIC AND FIRE SERVICE)

Ductile iron with ball joints rated for 250 PSI working pressure conforming to ANSI/AWWA A21.53/C153, capable of deflecting a minimum of 30 degrees and expanding simultaneously to the amount shown on the drawings. Flexible expansion joint shall have the expansion capability designed as an integral part of the ductile iron ball castings. Pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be factory holiday tested with a 1500 volt spark test. Flexible expansion joint shall have flanged connections conforming to ANSI/AWWA A21.11/C110. Bolts and nuts high strength steel with synthetic gaskets that comply with AWWA C110.

2.09 POTABLE WATER:

Water used for filling, flushing, and disinfection of water mains and appurtenances shall conform to Safe Drinking Water Act.

2.10 DISINFECTION CHLORINE:

- A. Liquid chlorine shall conform to AWWA B301 and AWWA C651.
- B. Sodium hypochlorite shall conform to AWWA B300 with 5 percent to 15 percent available chlorine.
- C. Calcium hypochlorite shall conform to AWWA B300 supplied in granular form or 5.g tablets, and shall contain 65 percent chlorine by weight.

2.11 WARNING TAPE

Standard, 4-Mil polyethylene 3 inch wide tape, detectable type, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW".

PART 3 - EXECUTION

3.1 BUILDING SERVICE LINES:

Install water service lines to point of connection within approximately 5 feet outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed provide temporary caps.

3.2 REGRADING:

Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

3.3 PIPE LAYING, GENERAL:

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Project Manager.
- B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Government. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.
- C. All buried piping shall be installed to the lines and grades as shown on the drawings. All underground piping shall slope uniformly between joints where elevations are shown.
- D. Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing underground water line and power lines, and all existing structures.
- E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
- G. Hold pipe securely in place while joint is being made.
- H. Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 12 inches over pipe.
- I. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
- J. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. See section 3.6 "PIPE SUPPORTS".
- K. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.
- L. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.

M. Warning tape shall be continuously placed 12 inches above buried water pipes.

3.4 DUCTILE IRON PIPE:

A. Installing Pipe: Lay pipe in accordance with AWWA C600 with polyethylene encasement if required in accordance with AWWA C105. Provide a firm even bearing throughout the length of the pipe by tamping selected material at the sides of the pipe up to the spring line.

B. All pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.

C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Bevel cut ends of pipe to be used with push-on bell to conform to the manufactured spigot end. Cement lining shall be undamaged.

D. Jointing Ductile-Iron Pipe:

1. Push-on joints shall be made in strict accordance with the manufacturer's instruction. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe is to be aligned with the bell of the pipe to which it is joined, and pushed home with approved means.

2. Mechanical Joints at Valves, Fittings: Install in strict accordance with AWWA C111. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gaskets with soapy water before tightening the bolts. Bolts shall be tightened to the specified torque.

3. Ball Joints: Install in strict accordance with the manufacturer's instructions. Where ball joint assemblies occur at the face of structures, the socket end shall be at the structure and ball end assembled to the socket.

4. Flanged joints shall be in accordance with AWWA C115. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

3.5 PVC PIPE:

A. PVC piping shall be installed in strict accordance with the manufacturer's instructions and AWWA 605. Place selected material and

thoroughly compacted to one foot above the top of the pipe and thereafter back filled as specified in Section 31 20 00, EARTH MOVING.

B. Copper Tracer Wire: Copper tracer wire consisting of No. 14 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 300 m (1000 feet), provide a 2.3 kg (5 pound) magnesium anode attached to the main tracer wire by solder. The solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.

C. Magnetic markers may be used in lieu of copper tracer wire to aid in future pipe locating. Generally, install markers on 20 foot centers. If pipe is in a congested piping area, install on 10 foot centers. Prepare as-built drawing indicating exact location of magnetic markers.

3.6 PIPE SUPPORTS:

A. Supports:

1. All piping shall be properly and adequately supported. Hangers, supports, base elbows and tees, and concrete piers and pads shall be provided as indicated on the drawings. If the method of support is not indicated on the drawings, exposed piping shall be supported by hangers wherever the structure is suitable and adequate to carry the superimposed load. Supports shall be placed approximately 8 feet on centers and at each fitting.
2. Hangers shall be heavy malleable iron of the adjustable swivel type, split ring type, or the adjustable-swivel, pipe-roll type for horizontal piping and adjustable, wrought iron, clamp type for vertical piping. Flat steel strap or chain hangers are not acceptable unless indicated on the drawings.
3. Hangers shall be attached to the structure, where possible, by beam clamps and approved concrete inserts set in the forms before concrete is poured. Where this method is impractical, anchor bolts with expanding lead shields, rawl drives, or malleable iron expansion shields will be permitted.

4. Where hangers cannot be used, the Contractor shall provide pipe saddle supports with pipe column and floor flange.

3.7 RESTRAINED JOINTS:

A. Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "locked-type" joints and the joints shall be capable of holding against withdrawal for line pressures

50 percent above the normal working pressure but not less than 1375 kPa (200 psi). The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.

B. The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be as shown on the drawings.

C. Restrained joint assemblies with ductile iron mechanical joint pipe shall be "Flex-Ring", "Lok-Ring", or mechanical joint coupled as manufactured by American Cast Iron Pipe Company, "Mega-Lug" or approved equal.

D. Ductile iron pipe bell and spigot joints shall be restrained with EBBA Iron Sales, Inc. Series 800 Coverall or approved equal.

E. Ductile iron mechanical joint fittings shall be restrained with EBBA Iron Sales, Inc. Series 1200 Restrainer. The restraining device shall be designed to fit standard mechanical joint bells with standard T head bolts conforming to AWWA C111 and AWWA C153. Glands shall be manufactured of ductile iron conforming to ASTM A536. Set screws shall be hardened ductile iron and require the same torque in all sizes. Steel set screws not permitted. These devices shall have the stated pressure rating with a minimum safety factor of 2:1. Glands shall be listed with Underwriters Laboratories and/or approved by Factory Mutual.

F. Thrust blocks shall not be permitted.

G. Where ductile iron pipe manufactured with restrained joints is utilized, all restrained joints shall be fully extended and engaged prior to back filling the trench and pressurizing the pipe.

H. PVC pipe bell and spigot joints shall be restrained with the Uni-Flange Corp. Series 1350 Restrainer or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536. Clamping bolts and nuts shall be manufactured of

corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.

I. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained with UNI-Flange Corp. Series 1300 Restrainer, EBBA Iron, Inc, Series 2000PV Mechanical Joint Restrainer Gland, or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A-536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.

3.8 PIPE SEPARATION:

A. Horizontal Separation-Water Mains and Sewers:

1. Water mains shall be located at least 10 feet horizontally from any proposed drain, storm sewer, sanitary or sewer service connection.
2. Water mains may be located closer than 10 feet to a sewer line when:
 - a. Local conditions prevent a lateral separation of 10 feet; and
 - b. The water main invert is at least 18 inches above the crown of the sewer; and
 - c. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located one side of the sewer.
3. When it is impossible to meet (1) or (2) above, both the water main and drain or sewer shall be constructed of mechanical joint ductile iron pipe. Ductile iron pipe shall comply with the requirements listed in this specification section. The drain or sewer shall be pressure tested to the maximum expected surcharge head before back filling.

B. Vertical Separation-Water Mains and Sewers:

1. A water main shall be separated from a sewer so that its invert is a minimum of 18 inches above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
2. Both the water main and sewer shall be constructed of slip-on or

mechanical joint ductile iron pipe or PVC pipe equivalent to water main standards of construction when:

- a. It is impossible to obtain the proper vertical separations described in (1) above; or
 - b. The water main passes under a sewer or drain.
3. A vertical separation of 18 inches between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking the water main.
4. Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least 10 feet.

3.9 SETTING OF VALVES AND BOXES:

- A. Provide a surface concrete pad 18 by 18 by 6 inches to protect valve box when valve is not located below pavement.
- B. Clean valve and curb stops interior before installation.
- C. Set valve and curb stop box cover flush with finished grade.
- D. Valves shall be installed plumb and level and in accordance with manufacturer's recommendations.

3.10 SETTING OF FIRE HYDRANTS:

- A. Set center of each hydrant not less than 2 feet nor more than 6 feet back of edge of road or face of curb. Fire apparatus connection shall face road with center of nozzle 18 inches above finished grade. Set barrel flange not more than 2 inches above finished grade.
- B. Set each hydrant on a slab of stone or concrete not less than 4 inches thick and 15 inches square. The service line to the hydrant, between the tee and the shoe of the hydrant, shall be fully restrained.
- C. Set bases in not less than 1/2 cubic yard of crushed rock or gravel placed entirely below hydrant drainage device.
- D. Clean interiors of hydrants of all foreign matter before installation.

3.11 PIPE SLEEVES:

Install where water lines pass through retaining walls, building foundations and floors. Seal with modular mechanical type link seal. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

3.12 FLUSHING AND DISINFECTING:

A. Flush and disinfect new water lines in accordance with AWWA C651. B. Initial flushing shall obtain a minimum velocity in the main of 2.5 feet per second at 40 PSI residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line.

Pipe Diameter		Flow Required to Produce 2.5 ft/sec (approx.)		Number of Hydrant Outlets			
				Size of Tap. in. (mm)			
				1 (25)	1	2 (51)	2 1/2-in
In	(mm)	gpm	(L/sec)	Number of taps on pipe			
4	(100)	100	(6.3)	1	--	--	1
6	(150)	200	(12.6)	--	1	--	1
8	(200)	400	(25.2)	--	2	1	1
10	(250)	600	(37.9)	--	3	2	1
12	(300)	900	(56.8)	--	--	3	2
16	(400)	1,600	(100.9)	--	--	4	2

C. The Contractor shall be responsible to provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used, and the Contractor shall provide all required temporary pumps, storage facilities required to complete the specified flushing, and disinfection operations.

D. The Contractor shall be responsible for the disposal of all water used to flush and disinfect the system in accordance with all governing rules and regulations. The discharge water shall not be allowed to create a nuisance for activities occurring on or adjacent to the site.

E. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the Department of Environmental Quality of the State. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor.

F. Re-disinfection and bacteriological testing of failed sections of the system shall be the sole responsibility of the Contractor.

G. Before backflow preventers are installed, all upstream piping shall be thoroughly flushed.

3.13 HYDROSTATIC TESTING:

- A. Hydrostatic testing of the system shall occur prior to disinfecting the system.
- B. After new system is installed, except for connections to existing system and building, backfill at least 12 inches above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.
- C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.
- D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.
- E. The Contractor shall install corporation stops in the line as required to purge the air out of the system. At the completion of the test, all corporation stops shall be capped.
- F. The Contractor shall perform pressure and leakage tests for the new system for 2 hours to 200 psi. Leakage shall not exceed the following requirements.
 - 1. Ductile Iron Pipe: AWWA C600. Provide to Project Manager office.
 - 2. Polyvinyl Chloride (PVC) AWWA C605. Provide to Project Manager office.

- - - E N D - - -

SECTION 33 30 00
SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION:

Outside, underground sanitary sewer system, complete, ready for operation, including all gravity flow lines, manholes, cleanouts, frames, covers, structures, appurtenances, and connections to new building and structure, service lines, existing sanitary sewer lines, and existing sanitary structures, and all other incidentals.

1.2 RELATED WORK:

A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.

B. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING. Dewatering: Section 31 23 19, DEWATERING.

C. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.

D. Protection of Materials and Equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

E. Sanitary Sewer Pumping Facilities, Division 22, PLUMBING.

1.3 QUALITY ASSURANCE:

A. Products Criteria:

1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, including model number, securely affixed in a conspicuous place on equipment, or name or trademark, including model number cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

1.4 SUBMITTALS:

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

B. Manufacturers' Literature and Data: Submit the following as one package:

1. Pipe, Fittings, and, Appurtenances.
2. Jointing Material.
3. Manhole and Structure Material.
4. Frames and Covers.
5. Steps and Ladders.

1.5 APPLICABLE PUBLICATIONS:

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

B. American Society for Testing and Materials (ASTM): A536-

84(2004).....Ductile Iron Castings

A615/A615M-06.....Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement

A625/A625M-03.....Tin Mill Products, Black Plate, Single Reduced

A746-03.....Ductile Iron Gravity Sewer Pipe

C76-05b/C76M-05b.....Reinforced Concrete Culvert, Storm Drain and
Sewer Pipe

C150-05.....Portland Cement

C478-06a/C478M-06a.....Precast Reinforced Concrete Manhole Sections

C857-95(2001).....Minimum Structural Design Loading for
Underground Precast Concrete Utility Structures

D698-00ae1.....Laboratory Compaction Characteristics of Soil
Using Standard Effort 12,400 ft-lbf/ft³

D2321-05.....Underground Installation of Thermoplastic Pipes for
Sewers and Other Gravity-Flow Applications

D2412-02.....Determination of External Loading Characteristics of
Plastic Pipe by Parallel- Plate Loading

D2992-01.....Practice for Obtaining Hydrostatic or Pressure Design
Basis for Fiberglass (Glass-Fiber- Reinforced Thermosetting-Resin) Pipe and
Fittings

D3034-04a.....Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and
Fittings

D3212-96a (2003) e1.....Joints for Drain and Sewer Plastic Pipes Using
Flexible Elastomeric Seals

F477-02e1.....Elastomeric Seals (Gaskets) for Joining Plastic
Pipe

F679-06.....Poly (vinyl chloride) (PVC) Large-Diameter
Plastic Gravity Sewer Pipe and Fittings

F714-05.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based on
Outside Diameter

F794-03.....Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and
Fittings Based on Controlled Inside Diameter

F949-03.....Poly (Vinyl Chloride) (PVC) Corrugated Sewer
Pipe with Smooth Interior and Fittings

C. American Water Works Association (AWWA):

C110/A21.10-03.....Ductile-Iron and Gray-Iron Fittings for Water

1. Ductile Iron Pipe (DIP) for Sanitary Sewer: Shall conform to ASTM A746, thickness Class 51 unless otherwise shown or specified. Joints on pipe and fittings shall be push-on style and conform to AWWA C110 and AWWA C111, rated for 1.03 MPa (150 psi). Exterior coating shall be approximately 1 mil asphaltic coating as specified in ASTM A746.

Interior lining shall be a catalyzed coal tar epoxy, having a minimum thickness of 24 mils, a permeability rating of 0.13 perms, direct impact rating of 100 in-lbs, an abrasion resistance of 20 liters of sand per mil, and dielectric strength of 250 volts per mil. Pipe and fittings shall be polyethylene encased with 8 mil polyethylene sheeting per AWWA C105. Color of polyethylene encasement shall be green.

2. Polyvinyl Chloride (PVC):

a. Pipe and Fittings, 4 to 15 inches in diameter, shall conform to ASTM D3034, Type PSM, SDR 35. Pipe and fittings shall have elastomeric gasket joints providing a watertight seal when tested in accordance with ASTM D3212. Gaskets shall conform to ASTM F477. Solvent welded joints shall not be permitted.

b. Pipe and fittings, 18 to 36 inches in diameter, shall be solid wall or have a corrugated or ribbed exterior profile and a smooth interior. Pipe shall conform to the following:

1) Pipe and fittings shall conform to ASTM F949 corrugated sewer pipe with a smooth interior. The corrugated outer wall shall be fused to the smooth interwall at the corrugation valley. Pipe and fitting shall have a smooth bell, elastomeric joints conforming to ASTM D3212, and shall have a minimum pipe stiffness of 50 psi at 5 percent deflection, when tested in accordance with ASTM D2412. Corrugation shall be perpendicular to the axis of the pipe to allow gaskets to be installed on field cut sections of pipe without the requirement for special fittings.

2) Ribbed wall PVC pipe and fittings shall conform to ASTM F794 ribbed sewer pipe with smooth interior pipe and fittings shall have a smooth bell, elastomeric joints conforming to ASTM D3212, and shall have a minimum pipe stiffness of 46 psi when tested in accordance with ASTM D 2412, at 5 percent vertical

deflection. Joints shall not leak at 25 feet of head under 5 percent deflection.

2.2 JOINTING MATERIAL:

A. Gravity Flow Lines:

1. Ductile Iron Pipe: Push-on or mechanical joints, AWWA C111, AWWA C110. Flange joints shall comply with AWWA C115. Flange joints shall only be used in vaults or above-grade.

2. Polyvinyl Chloride (PVC) Pipe (Gravity Use): Joints, ASTM D3212. Elastomeric gasket, ASTM F477.

2.3 MANHOLES AND VAULTS:

A. Manholes and vaults shall be constructed of precast concrete segmental blocks, precast reinforced concrete rings, precast reinforced sections, or cast-in-place concrete. The manholes and vaults shall be in accordance with State Department of Transportation or State Roads Commission standard details, and the following:

1. Precast Concrete Segmental Blocks: Blocks shall conform to ASTM C139 and shall not be less than 6 inches thick for manholes to a depth of 12 feet; not less than 8 inches thick for manholes deeper than 12 feet deep. Blocks shall be not less than 8 inches in length. Blocks shall be shaped so that joints seal and bond effectively with cement mortar. Parge structure interior and exterior with 1/2 inch of cement mortar applied with a trowel and finished to an even glazed surface.

2. Precast Reinforced Concrete Rings: Rings or sections shall have an inside diameter as indicated on the drawings, and shall be not less than 48 inches in diameter. Wall thickness shall conform to requirements of ASTM C76, except that lengths of the sections may be shorter as conditions require. Tops shall conform to ASTM C478. Top section shall be eccentric cone type. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.

3. Precast Reinforced Concrete Manhole Risers and Tops: Design, material and installation shall conform to requirements of ASTM C478. Top sections shall be eccentric. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.

4. Flat top manhole tops shall be reinforced concrete as detailed on the drawings.

5. Vaults: Reinforced concrete, as indicated on the plans, or precast reinforced concrete. Concrete for precast sections shall have a minimum compressive strength of 5,000 psi at 28 days, ASTM A615, Grade 60 reinforcing steel, rated for AASHTO HS20-44 loading with 30 percent impact, and conform to ASTM C857.

6. Mortar:

a. Precast Concrete Segmental Block Structures: By volume, 1 part of Portland cement, 1/4 part lime hydrate, and 3 parts sand.

b. Precast Reinforced Concrete Ring and Riser Structures: By volume, 1 part of Portland cement and 2 parts sand. Water in mixture shall produce a stiff, workable mortar, but shall not exceed 5-1/2 gallons per sack of cement.

7. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet AASHTO M198.

8. Frames and covers shall be gray cast iron conforming to ASTM A48. The frame and cover shall be rated for HS20-44 loading, have a studded pattern on the cover, and the words "sanitary sewer". The studs and the lettering shall be raised 5/16 inch. The cover shall be a minimum of 24 inches in diameter and shall have four 3/4 inch vent holes and two lifting slots. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.

9. Manhole steps shall be polypropylene plastic coated on a No. 4 deformed rebar conforming to ASTM C478, Polypropylene shall conform to ASTM D4101. Steps shall be a minimum of 16 inches wide and project a minimum of 7 inches away from the wall. The top surface of the step shall have a studded non-slip surface. Steps shall be placed at 12 inch centers.

10. Ladders, brackets and hardware shall be constructed of welded aluminum, rails shall be 3/8 inch by 63 2-1/2 inches spaced a minimum

of 16 inches apart. Rungs shall 1-3/8 inches in diameter and have a non-slip surface. Standoffs shall offset the ladder 7 inches from the wall. The ladder assembly shall be rated for a minimum of 500 pounds.

2.4 CONCRETE:

Concrete shall have a minimum compressive strength of 3000 psi at 28 days. The cement shall be Type III conforming to ASTM C150. Concrete shall conform with the provisions of Division 03 of these specifications.

2.5 REINFORCING STEEL:

Reinforcing steel shall be deformed bars, ASTM A615, Grade 40 unless otherwise noted.

2.6 CONCRETE PROTECTIVE COATING:

Concrete coating for the interior of wet wells shall consist of an epoxy blended filler sealer, and a cross linked epoxy phenolic cured, resistant protective coating.

2.7 CLEANOUT FRAMES AND COVERS:

Frames and covers shall be gray iron casting conforming to ASTM C48. The frame and cover shall be rated for HS20-44 wheel loading, have a studded pattern on its cover, vent holes, and lifting slots. The cover shall fit firmly on the frame without movement when subject to vehicular traffic. The word "SEWER" shall be cast on the cover.

2.8 WARNING TAPE:

Standard, 4Mil polyethylene 3 inch wide tape, detectable type, green with black letters and imprinted with "CAUTION BURIED SEWER LINE BELOW".

PART 3 - EXECUTION

3.1 BUILDING SERVICE LINES:

A. Install sanitary sewer service lines to point of connection within approximately 5 feet outside of buildings where service is required and

make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines.

B. Connections of service line to building piping shall be made after the new sanitary sewer system has been constructed, tested, and accepted for operation by the Resident Engineer. The Contractor shall install all temporary caps or plugs required for testing.

C. When building services have not been installed at the time when the sanitary sewer system is complete, provide temporary plugs or caps at the ends of all service lines. Mark the location and depth of the service lines with continuous warning tape placed 300 mm (12 inches) above service lines.

3.2 REGRADING:

A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

C. The Contractor shall comply with all OSHA confined space requirements when working within existing structures.

3.3 CONNECTIONS TO EXISTING VA OWNED MANHOLES:

A. During construction of new connections to existing manholes, it shall be the sole responsibility of the Contractor to maintain continued sanitary sewer service to all buildings and users upstream. The contractor shall provide, install, and maintain all pumping, conveyance system, dams, weirs, etc. required to maintain the continuous flow of sewage. All

temporary measures required to meet this requirement shall be subject to the review of the Resident Engineer.

B. Core existing structure, install pipe at the design invert. Install an elastomeric gasket around the pipe, and grout the interstitial space between the pipe and the core.

C. The bench of the manhole shall be cleaned and reshaped to provide a smooth flowline for all pipes connected to the manhole.

D. Connections and alterations to existing manholes shall be constructed so that finished work conforms as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting and shaping.

3.4 CONNECTIONS TO EXISTING PUBLIC UTILITY COMPANY MANHOLES:

A. Comply with all rules and regulations of the public utility.

B. The connection to the existing utility shall comply with the standard details and specifications of the public utility company, except as specifically modified on the plans and specifications.

3.5 PIPE SEPARATION:

A. Horizontal Separation - Water Mains and Sewers:

1. Existing and proposed water mains shall be at least 10 feet horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.

2. Gravity flow mains and pressure (force) mains may be located closer than 10 feet but not closer than 6 feet to a water main when:

a. Local conditions prevent a lateral separation of ten feet; and

b. The water main invert is at least 18 inches above the crown of the gravity sewer or 24 inches above the crown of the pressure (force) main; and

c. The water main is in a separate trench separated by undisturbed earth.

3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe. The pipe for the sanitary sewer main shall comply with the specifications for pressure (force) mains, and the water main material shall comply with Section 33 10 00, WATER UTILITIES. The sewer shall be pressure tested as specified for pressure (force) mains before backfilling.

B. Vertical Separation - Water Mains and Sewers at Crossings:

1. Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 24 inches above the crown of gravity flow sewer or 48 inches above the crown of pressure (force) mains.

The vertical separation shall be maintained within 10 feet horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.

2. In no case shall pressure (force) sanitary main cross above, or within 24 inches of water lines.

3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 18 inches above or 12 inches below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 24 inches below the water line provided both the water line and sewer line are constructed of ductile iron pipe. The pipe for the sewer shall conform to the requirements for pressure sewers specified herein. Piping for the water main shall conform to Section 33 10 00, WATER UTILITIES.

4. The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 10 feet.

3.6 GENERAL PIPING INSTALLATION:

A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade. Pressure (force) mains shall have the bells facing the direction of flow.

B. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.

C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.

D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.

E. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.

F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.

G. Do not lay sewer pipe in same trench with another pipe or other utility. Sanitary sewers shall cross at least 2 feet below water lines.

H. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 12 inches over the crown of the pipe.

I. Warning tape shall be continuously placed 12 inches above sewer pipe

J. Install gravity sewer line in accordance with the provisions of these specifications and the following standards:

1. Ductile Iron Piping: AWWA C111 and C600.
3. Polyvinyl Chloride (PVC) Piping: ASTM D2321.

3.7 MANHOLES AND VAULTS:

A. General:

1. Circular Structures:

a. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch or cement mortar applied with a trowel and finished to an even glazed surface.

b. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top, shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.

c. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

2. Do not build structures when air temperature is 032 degrees F, or below.

3. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:

a. Forming directly in concrete base of structure. b. Building

up with brick and mortar.

4. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1:12 (1-inch per foot) nor more than 1:6 (2 inches per foot). Bottom slab and benches shall be concrete.

5. The wall that support access rungs or ladder shall be 90 degrees vertical from the floor of structure to manhole cover.

6. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.

7. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 2 inches above the adjacent finish grade. Install 8 inches thick by 12 inches concrete

collar around the perimeter of the frame.
collar away from the frame.

Slope the top of the

3.8 SEWER AND MANHOLE SUPPORTS, CONCRETE CRADLES:

Reinforced concrete as detailed on the drawings. The concrete shall not restrict access for future maintenance of the joints within the piping system.

3.9 CLEANOUTS:

A. 6 inches in diameter and consisting of a ductile iron 45 degree fitting on end of run, or combination Y fitting and 1/8 bend in the run with ductile iron pipe extension, water tight plug or cap and cast frame and cover flush with finished grade. Center-set cleanouts, located in unpaved areas, in a 12 by 12 by 6 inches thick concrete slab set flush with adjacent finished grade.

B. The top of the cleanout assembly shall be 2 inches below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

3.10 INSPECTION OF SEWERS:

Inspect and obtain the Resident Engineer's approval. Thoroughly flush out before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lips at joints on the inside of gravity sewer lines are not acceptable.

3.11 TESTING OF SANITARY SEWERS:

A. Gravity Sewers and Manholes

1. Air Test: PVC Pipe, Uni-Bell Uni-B-6. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line shall be pressurized to 4 psi and allowed to stabilize. After pressure stabilization, the pressure shall be dropped to 3.5 psi greater than the average back-pressure of any groundwater above the sewer. The minimum test time shall be as specified in Uni-Bell Uni-B-6.

2. Exfiltration Test:

a. Subject pipe to hydrostatic pressure produced by head of water at depth of 3 feet above invert of sewer at upper manhole under test. In areas where ground water exists, head of water shall be 3 feet above existing water table. Maintain head of water for one hour for full absorption by pipe body before testing. During one hour test period, measured maximum allowable rate of exfiltration for any section of sewer shall be 3.0 gallons per hour per 100 feet.

b. If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.

3. Infiltration Test: If ground water level is greater than 3 feet above invert of the upper manhole, infiltration tests are acceptable. Allowable leakage for this test will be the same as for the exfiltration test.

- - - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 40 00
STORM SEWER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.
- E. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- F. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 ABBREVIATIONS

- A. HDPE: High-density polyethylene
- B. PE: Polyethylene

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle manholes and stormwater inlets according to manufacturer's written rigging instructions.

1.5 COORDINATION

- A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.
- B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.6 QUALITY ASSURANCE:

- A. Products
- Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.7 SUBMITTALS

A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

1.8 APPLICABLE PUBLICATIONS

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

B. American Society for Testing and Materials

(ASTM) :

A185/A185M-07Steel Welded Wire Reinforcement, Plain, for
Concrete

A615/A615M-09bDeformed and Plain Carbon-Steel Bars for
Concrete Reinforcement

A760/A760M-10Corrugated Steel Pipe, Metallic-Coated for
Sewers and Drains

A798/A798M-07Installing Factory-Made Corrugated Steel Pipe for
Sewers and Other Applications

A849-10Post-Applied Coatings, Paving, and Linings for
Corrugated Steel Sewer and Drainage Pipe

A929/A929M-01 (2007)Steel Sheet, Metallic-Coated by the Hot-Dip
Process for Corrugated Steel Pipe

B745/B745M-97 (2005) ...Corrugated Aluminum Pipe for Sewers and Drains

C33/C33M-08Concrete Aggregates

C76-11Reinforced Concrete Culvert, Storm Drain, and
Sewer Pipe

C150/C150M-11Portland Cement

C443-10Joints for Concrete Pipe and Manholes, Using
Rubber Gaskets

C478-09.....Precast Reinforced Concrete Manhole Sections
C857-07.....Minimum Structural Design Loading for
Underground Precast Concrete Utility Structures
C891-09Installation of Underground Precast Concrete
Utility Structures
C923-08Resilient Connectors Between Reinforced
Concrete Manhole Structures, Pipes,
and Laterals
C924-02 (2009)Testing Concrete Pipe Sewer Lines by Low-
Pressure Air Test Method
C990-09Joints for Concrete Pipe, Manholes, and Precast Box
Sections Using Preformed Flexible Joint Sealants
C1103-03 (2009)Joint Acceptance Testing of Installed Precast
Concrete Pipe Sewer Lines
C1433-10.....Precast Reinforced Concrete Monolithic Box
Sections for Culverts, Storm Drains, and Sewers
C1479-10.....Installation of Precast Concrete Sewer, Storm Drain,
and Culvert Pipe Using Standard Installations
D698-07e1.....Laboratory Compaction Characteristics of Soil Using
Standard Effort (12 400 ft-lbf/ft³
(600 kN-m/m³))
D1056-07.....Flexible Cellular Materials—Sponge or Expanded
Rubber
D2321-11.....Underground Installation of Thermoplastic Pipe for
Sewers and Other Gravity-Flow
Applications
D3350-10Polyethylene Plastics Pipe and Fittings
Materials
D4101-11.....Polypropylene Injection and Extrusion Materials
F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic
Pipe
F714-10Polyethylene (PE) Plastic Pipe (SDR-PR) Based on
Outside Diameter
F1417-11.....Installation Acceptance of Plastic Gravity Sewer
Lines Using Low-Pressure Air

F1668-08Construction Procedures for Buried Plastic Pipe
C. American Association of State Highway and Transportation Officials (AASHTO):
M198-10Joints for Concrete Pipe, Manholes, and Precast
Box Sections Using Preformed Flexible Joint
Sealants
M252-09Corrugated Polyethylene Drainage Pipe
M294-10Corrugated Polyethylene Pipe, 12 to 60 In.
Diameter
D. American Society of Mechanical Engineers (ASME):
A112.6.3-2001Floor and Trench Drains

A112.14.1-2003Backwater Valves

A112.36.2M-1991Cleanouts
E. American Concrete Institute (ACI):
318-05Structural Commentary and Commentary
350/350M-06Environmental Engineering Concrete Structures and
Commentary

1.9 WARRANTY

The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers' and suppliers' written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements. The 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.

2.2 PE PIPE AND FITTINGS

A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.
1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.

B. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500); AASHTO M294, Type S with smooth waterway for coupling joints. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.

1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class

A, Grade 2 gasket material that mates with tube and fittings. C. Profile

Wall PE Pipe: Pipe shall comply with ASTM F894, Class 160.

1. Profile Wall PE Plastic Pipe Joints: Joints shall be as per ASTM F894, gasket weld type with integral bell.

2.3 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete sewer pipe and fittings shall be ASTM C76 or ASTM C655.

1. Bell-and-spigot or ends and gasketed joints with ASTM C443, rubber gaskets

2.4 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials

1. For concrete pipes: ASTM C443, rubber.

2. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.

3. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with stainless-steel shear ring, corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-

resistant-metal tension band and tightening mechanism on each end. E.

Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.5 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and

countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification(s): Heavy Duty

2. Pipe fitting and riser to cleanout shall be same material as main pipe line.

2.6 DRAINS

A. Cast-Iron Area Drains: ASME A112.6.3, gray-iron round body with anchor flange and round grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

1. Top-Loading Classification(s): Heavy Duty

2.7 MANHOLES AND CATCH BASINS

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Diameter: 48 inches minimum unless otherwise indicated.

3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.

4. Base Section: 6 inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.

5. Riser Sections: 4 inch minimum thickness, and lengths to provide depth indicated.

6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab- top type is indicated, and top of cone of size that matches grade rings.

7. Joint Sealant: ASTM C990, bitumen or butyl rubber.

8. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.

9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches. Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D4101, PP width of 16 inches minimum, spaced at 12 to 16 inch intervals.

10. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

2.8 CONCRETE FOR MANHOLES AND CATCH BASINS

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

B. Concrete Design Mix: 4000 psi minimum, compressive strength in 28 days.

1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615, Grade 60 deformed steel.

C. Manhole Channels and Benches: Channels shall be the main line pipe material. Include benches in all manholes and catch basins.

1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel. Minimum of 6 inch slope from main line pipe to wall sides.

2.9 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS

A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets, and shall conform to ASTM C923.

2.10 WARNING TAPE

A. Standard, 4-Mil polyethylene 3 inch wide tape detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

PART 3 - EXECUTION

3.1 PIPE BEDDING

A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB

or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

3.2 PIPING INSTALLATION

A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping with inch minimum cover as shown on the Drawings.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.

2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.

3. Inspect pipes and fittings, for defects before installation.

Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.

4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.

5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.

6. Do not walk on pipe in trenches until covered by layers of shading to a depth of **12 inches** over the crown of the pipe.

7. Warning tape shall be continuously placed 12 inches above storm sewer piping.

D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected.

Reducing size of piping in direction of flow is prohibited.

F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

G. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
3. Install ductile iron piping and special fittings according to AWWA C600.
4. Install PE corrugated sewer piping according to ASTM D2321 with gasketed joints-
5. Install reinforced concrete sewer piping according to ASTM C1479.

3.3 REGRADING

A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES

A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

3.5 CONNECTIONS TO EXISTING PUBLIC UTILITY MANHOLES

A. Cleanout Installation

1. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast iron soil pipe fittings in sewer pipes at branches for cleanouts and cast iron soil pipe for riser extensions

to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

a. Use Heavy-Duty, top-loading classification cleanouts in **all** areas.

2. Set cleanout frames and covers in earth in cast in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 MANHOLE INSTALLATION

A. Install manholes, complete with appurtenances and accessories indicated.

Install precast concrete manhole sections with sealants according to ASTM C891.

B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

C. Circular Structures:

1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch or cement mortar applied with a trowel and finished to an even glazed surface.

2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.

3. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

D. Rectangular Structures:

1. Precast concrete structures shall be placed on a 8 inch (200 mm) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section shall be set on an

8 inch thick aggregate base course compacted to a minimum of **98** percent of the maximum density as determined by ASTM D698. Set

precast section true and plumb.
flexible gasket material.

Seal all joints with perform

2. Do not build structures when air temperature is 32 deg F or below.
3. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
 - a. Forming directly in concrete base of structure.
 - b. Building up with brick and mortar.
4. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1 to 12 or more than 1 to 6. Bottom slab and benches shall be concrete.
5. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.
6. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
7. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade. Install an 8 inch (203 mm) thick, by 12 inch (300 mm) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.8 STORMWATER INLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete.
- B. Construct riprap of broken stone.
- C. Install outlets that spill onto grade, anchored with concrete. D. Install outlets that spill onto grade, with flared end sections that match pipe.
- E. Construct energy dissipaters at outlets.

3.9 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm

building drains specified in Division 22 Section FACILITY STORM
DRAINAGE PIPING.

B. Encase entire connection fitting, plus 6 inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi. C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy- bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Shielded flexible couplings for same or minor difference OD pipes. b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.10 IDENTIFICATION

A. Install green warning tape directly over piping and at outside edge of underground structures.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Damage: Crushed, broken, cracked, or otherwise damaged piping. d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

3.12 TESTING OF STORM SEWERS:

A. Submit separate report for each test.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.

4. Submit separate report for each test.

5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.

C. Leaks constitute defects that must be repaired. Replace

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

leaking piping using new materials, and repeat testing until
leakage is within allowances specified.

3.13 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with
potable water.

- - - END - - -

SECTION 33 46 13
FOUNDATION DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies materials and procedures for construction of foundation drainage systems, including installation, backfill, and cleanout extensions, to a point of connection to storm sewer.

1.2 RELATED WORK

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1.3 DEFINITIONS

Subdrainage: Foundation drainage system that collects and removes subsurface or seepage water from building foundation from building to storm sewer.

1.4 ABBREVIATIONS

- A. HDPE: High-density polyethylene plastic. B.
- PE: Polyethylene plastic.
- C. PVC: Polyvinyl chloride plastic.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.6 COORDINATION

- A. Coordinate connection to storm sewer main, if approved, with the Public Agency responsible for the storm sewer system.
- B. Coordinate exterior utility lines and connections to foundation building drain.

1.7 QUALITY ASSURANCE:

- A. Products Criteria:
 - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one

manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with the rules and regulations of the Public Agency having jurisdiction over the connection to public storm sewer lines or the requirements for discharge of subsurface drainage.

1.8 APPLICABLE PUBLICATIONS

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

B. American Society for Testing and Materials (ASTM): A48-03 Gray Iron Castings

C33/C33M-11Concrete Aggregates

C1173-08Flexible Transition Couplings for Underground
Piping Systems

D448-08Sizes of Aggregate for Road and Bridge
Construction

D1621-10Standard Test Method for Compressive
Properties of Rigid Cellular Plastics

D2321-11Underground Installation of Thermoplastic Pipe
for Sewers and Other Gravity-Flow Applications

D3034-08Type PSM Poly (Vinyl Chloride) (PVC) Sewer
Pipe and Fittings

D3350-10aPolyethylene Plastic Pipe and Fittings Material

D4491-99a(2009)Test Methods for Water Permeability of
Geotextiles by Permittivity

D4716-08Test Method for Determining the (In-plane) Flow Rate
per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using
a Constant Head

D5926-09Poly (Vinyl Chloride) (PVC) Gaskets for Drain,
Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

D6707-06 (2011)Circular-Knit Geotextile for Use in Subsurface
Drainage Applications
F405-05Corrugated Polyethylene (PE) Pipe and
Fittings
F477-10Elastomeric Seals (Gaskets) for Joining Plastic
Pipe
F2648-102 to 60 Inch Annular Corrugated Profile
Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications

1.9 WARRANTY

The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting there from within a period of two years from final acceptance. Further, the Contractor will furnish all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements.
B. 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.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 UNDERSLAB HEADER

A. PE pipe and fittings per ASTM F2648 **or** ASTM F405.
B. PVC sewer pipe and fittings per ASTM D3034, with ASTM F477, elastomeric seal gaskets.

2.4 PERFORATED-WALL PIPES AND FITTINGS FOR VAULTS OR MANHOLES

A. Perforated PE Pipe and Fittings:
1. Pipe shall be ASTM D2648 **or** ASTM F405, Type CP; corrugated, for coupled joints.
2. Couplings: Manufacturer's standard.

B. Perforated PVC Sewer Pipe and Fittings shall be ASTM D3034.

2.5 SOLID-WALL PIPES AND FITTINGS

A. PE Pipe and Fittings: ASTM D3350 or F405. B.

PVC Sewer Pipe and Fittings: ASTM D3034.

1. Gaskets: ASTM F477.

2.6 SPECIAL PIPE COUPLINGS

A. Comply with ASTM C1173 for joining underground non-pressure piping.

Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.

1. Sleeve Materials:

a. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

2. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant metal tension band and tightening mechanism on each end.

2.7 CLEANOUTS

A. Cleanouts: Cast-iron parts shall conform to ASTM A48. Lid shall be secured, scoriated, Highway Loading class. Include cast-iron ferrule and countersunk, brass cleanout plug.

2.8 DRAINAGE PANELS

A. Molded-Sheet Drainage Panels shall be Prefabricated geocomposite, 36 to 60 inches wide with drainage core faced with geotextile filter fabric.

1. Drainage Core shall be Three-dimensional, nonbiodegradable, molded plastic.

a. Minimum Compressive Strength shall be 18,000 lbf/sq. ft. when tested according to ASTM D1621.

b. Minimum In-Plane Flow Rate shall be 15 gpm/ft of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psi when tested according to ASTM D4716.

2. Filter Fabric shall be nonwoven geotextile fabric, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to ASTM D6707.

a. Survivability shall be Class 2.

b. Apparent Opening Size shall be No. 40 (0.425 mm) sieve, maximum. c. Permittivity shall be 0.2 per second, minimum.

2.9 SOIL MATERIALS

A. Drainage Material

1. Bedding shall be crushed stone, 3/4 inch to No. 4 per ASTM D448, at a minimum or as per geotechnical recommendations.
2. Fill to 1 foot above pipe shall be Crushed stone, 3/4 inch to No. 4 per ASTM D448, at a minimum or as per geotechnical recommendations.

B. Concrete Sand shall be ASTM C33.

2.10 GEOTEXTILE FILTER FABRICS

A. Geotextile fabric shall conform to ASTM 6707. Elongation will be greater than 50 percent and the flow rate shall range from 110 to 330 gpm/sq.ft.

1. Structure Type shall be Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.
2. Style(s) shall be Flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

3.2 PIPING APPLICATIONS

A. Underground Subdrainage Piping shall be:

1. Perforated PE pipe and fittings, couplings, and coupled joints.
2. Perforated PVC sewer pipe and fittings for loose, bell-and- spigot joints.

B. Underslab Subdrainage Piping shall be:

1. Perforated PE pipe and fittings, couplings, and coupled joints.
2. Perforated PVC sewer pipe and fittings and loose, bell-and- spigot joints.
3. Perforated concrete pipe and fittings, gaskets, and gasketed joints.

C. Header Piping shall be:

1. PE drainage tubing and fittings, couplings, and coupled joints.
2. PVC sewer pipe and fittings, couplings, and coupled joints.

3.3 CLEANOUT APPLICATIONS

A. In Underground Subdrainage Piping:

1. At Grade in Earth shall be Cast-iron cleanouts.
2. At Grade in Paved Areas shall be Cast-iron cleanouts.

B. In Underslab Subdrainage Piping:

1. In Equipment Yards and Unfinished Areas shall be Cast-iron cleanouts.

3.4 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape and install drainage piping.

E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Install vertical drainage panels as follows:

1. Coordinate placement with other drainage materials.

2. Lay perforated drainage pipe at base of footing. Do not install aggregate.

3. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.

4. Wrap bottom of panel around drainage pipe.

5. Attach panel to wall at horizontal mark and at beginning of pipe.

Place core side of panel against wall. Use concrete nails with washers through product cylinders to attach panel to wall. Place nails from 2 to 6 inches below top of panel, approximately 48 inches apart. Construction adhesives, metal stick pins, or double double-sided tape may be used instead of nails.

Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing

manufacturer.

6. If additional panels are required on same row, cut away 4 inches of installed panel core, install new panel against installed panel, and overlap new panel with installed panel fabric.

7. If additional rows of panels are required, overlap lower panel with 4 inches of fabric.

8. Cut panel as necessary to keep top 12 inches below finish grade.

9. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.

J. Do not use drainage panels as protection for waterproof membrane unless approved by factory-authorized service representative of waterproofing membrane manufacturer. Submit approval if so used.

K. Place initial backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm).

Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.5 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape. Install drainage piping.

E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

F. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

G. Install horizontal drainage panels as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at inside edge of footings.

3. Place drainage panel over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.

4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.

3.6 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape. Install drainage piping.

C. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.

D. After satisfactory testing, cover drainage piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade.

E. Place drainage course in layers not exceeding 3 inches (75 mm) in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

F. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches (100 mm). G.

Install vertical drainage panels as follows:

1. Coordinate placement with other drainage materials.

2. Lay perforated drainage pipe at base of footing. Do not install aggregate.

3. Mark horizontal chalk line on wall at a point 6 inches less than panel width above footing bottom. Before marking wall, subtract footing width.

4. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.

5. Wrap bottom of panel around drainage pipe.

6. Attach panel to wall at horizontal mark and at beginning of wall corner.

Place core side of panel against wall. Use concrete nails with washers through product. Place nails from 2 to 6 inches (50 to 150 mm) below top of panel, approximately 48 inches (1200 mm) apart. Construction adhesives, metal stick pins, or double-sided tape may be used instead of nails. Do not penetrate

waterproofing. Before using adhesives, discuss with waterproofing manufacturer.

7. If another panel is required on same row, cut away 4 inches of installed panel core and wrap fabric over new panel.
8. If additional rows of panel are required, overlap lower panel with 4 inches of fabric.
9. Cut panel as necessary to keep top 12 inches below finish grade.
10. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.
11. Do not use drainage panels as protection for waterproof membrane unless approved by factory-authorized service representative of waterproofing membrane manufacturer. Submit approval if so used.

H. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish grade.

3.7 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
2. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
3. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches (915 mm) unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
4. Lay perforated pipe with perforations down.
5. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE piping **and** PVC piping according to ASTM D2321.

3.8 PIPE JOINT CONSTRUCTION

A. Join PE pipe or perforated PE pipe, tubing, and fittings with couplings for soil-tight joints according to ASTM D2321.

B. Join PVC pipe and fittings according to ASTM D2729.

C. Join perforated PVC pipe and fittings according to ASTM D2729.

D. Join perforated concrete pipe and fittings with gaskets according to ASTM C443.

E. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.9 CLEANOUT INSTALLATION

A. Cleanouts for Foundation **and** Retaining-Wall Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

2. In **all** areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in nonvehicular-traffic areas.

B. Cleanouts for Underslab Subdrainage:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.10 CONNECTIONS

A. Connect low elevations of subdrainage system to solid- wall-piping storm drainage system.

B. Where required, connect low elevations of foundation **and** underslab subdrainage to stormwater sump pumps.

3.11 IDENTIFICATION

A. Install PE warning tape or detectable warning tape over ferrous piping. B. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.13 CLEANING

Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

-

- - E N D - - -

ICVA HEALTH CARE SYSTEM
IOWA CITY, IOWA
EXPAND BLDG 1 FOR PACT
VA PROJECT: 636-201

DEPARTMENT OF VETERANS AFFAIRS

THIS PAGE INTENTIONALLY LEFT BLANK