

- F. ***Air balance not to commence until ductwork shop drawings have been submitted to a design engineer for review acceptance.***

3.02 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

3.03 INSTALLATION TOLERANCES

- A. Adjust air moving systems to plus or minus 5 percent for supply systems and plus or minus 10 percent for return and exhaust systems from figures indicated.
- B. Adjust hydronic systems to plus or minus 10 percent of design conditions indicated.

3.04 ADJUSTING

- A. Recorded data shall represent actually measured or observed condition.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Provide labor at no additional cost to the Owner to change sheaves and belts as required to accomplish specified fan performance. Mechanical Contractor to provide material as required.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes and restoring thermostats to specified settings.
- F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Architect.

3.05 AIR SYSTEM PROCEDURE

- A. Adjust distribution systems to provide required or design supply, return and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

- E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

END OF SECTION

**DIVISION 16
ELECTRICAL**

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

- A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The Work required under this division, is not limited to the Electrical Drawings. Refer to Site, Architectural, Structural, and Mechanical Drawings that may designate Work to be accomplished. The intent of the Specifications is to provide a complete electrical system that includes all documents that are a part of the Contract.
1. Work Included: Furnish all labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on the Drawings, and its delivery to the Owner complete in all respects ready for use.
- B. Contract Drawings: The Contract Drawings are shown in part diagrammatic, intended to convey the Scope of Work indicating the intended general arrangement of equipment, conduit and outlets. Follow the contract drawings in laying out the work and verify spaces for the installation of the materials and equipment based on actual dimensions of equipment furnished. Where conflicts occur, the most stringent application shall apply wherever a question exists as to the exact intended location of outlets or equipment, obtain instructions from the Architect before proceeding with the Work.
- C. Equipment or Fixtures: Equipment and fixtures shall be connected to provide circuit continuity in accordance with the Specifications whether or not each piece of conductor, conduit, or protective device is shown between such items of equipment or fixtures, and the point of circuit origin.
- D. Work Installed but Furnished under Other Sections: The Electrical Work includes the installation or connection of certain materials and equipment furnished under other sections. Verify installation details. Foundations for apparatus and equipment will be furnished under other sections unless otherwise noted or detailed.

1.02 GENERAL REQUIREMENTS

- A. Guarantee: Furnish a written guarantee for a period of one year from date of substantial completion.
- B. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval.

Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety.

C. Codes and Regulations:

1. Design, manufacture, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:

Institute of Electrical and Electronic Engineers - IEEE
National Electrical Manufacturers' Association - NEMA
California Fire Code - CFC
California Building Code - CBC
Underwriters' Laboratories, Inc. - UL
National Fire Protection Association - NFPA
Federal Specifications - Fed. Spec.
American Society for Testing and Materials - ASTM
American National Standards Institute - ANSI
American Standard Association - ASA
California Electrical Code - CEC
National Electrical Safety Code - NESC
Insulated Power Cable Engineers Association - IPCEA
Public Utilities Commission - PUC
California Code of Regulations, Title 8, Subchapter 5
California Code of Regulations, Title 24
State & Municipal Codes in Force in the Specific Project Area
Occupational Safety and Health Administration -OSHA

The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.

D. Seismic Design of Electrical Equipment:

1. All electrical equipment shall be anchored or braced to meet the horizontal and vertical forces prescribed in the 2007 CBC, Section 1614A. 1.13 and ASCE 7-05 Sections 13.3, 13.4 and 13.6.
 - a. The attachment of the following items shall be designed to resist the forces prescribed above, but need not be detailed on the plans.
 - 1) Equipment weighting less than 400 pounds supported directly on the floor or the roof.
 - 2) Furniture required to be attached in accordance with Part 2, Title 24, C.C.R.
 - 3) Temporary or movable equipment.

- 4) Equipment weighting less than 20 pounds supported by vibration isolators.
- 5) Equipment weighting less than 20 pounds suspended from a roof or floor or hung from a wall.

b. For those elements that do not require details on the approved drawings, the installation shall be subject to the approval of the Electrical Engineer and the Field Representative of the DSA.

2. Electrical distribution systems shall be braced to resist the forces prescribed in ASCE 7-05 Section 13.3 as defined in ASCE 7-05 Section 13.6.8, 13.6.7 and 13.6.5.5, Item 6 respectively.
3. The bracing and attachments to the structure shall comply with one of the OSHPD pre-approvals with an CPA #, such as Mason Industries (OPA 349), or ISAT (OPS #485) as modified to satisfy anchorage requirements of ACI 318, Appendix D.
4. Copies of the manual shall be on the jobsite prior to starting handling and bracing of the pipe, ductwork and electrical distribution systems.
5. The Structural Engineer of Record shall verify the adequacy of the structure to support the hanger and brace loads.

E. Requirements of Regulatory Agencies:

1. Codes, Permits and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved. **Where provisions in the drawings and specifications differ in regard to code application, size, quality, quantity or type of equipment, Contractor shall include in the bid, costs for the most costly provision either denoted in the specifications or on the drawings. This provision shall apply as an amendment to the California Public Contracts Code.**
 - a. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the Work shall be obtained by the Contractor at his expense, unless otherwise specified.
 - b. Comply with the requirements of the applicable utility companies serving the Project. Make all arrangements with the utility companies for proper coordination of the Work.
2. **Substitutions: The materials, products, and equipment described in the Contract Documents establish a standard of required function, dimension, appearance, and quality. Architect may consider requests for substitutions of specified equipment, materials, or**

products and then only when request are submitted in accordance with the provisions of the Contract Documents, Division 1, and are received by the Architect a minimum of 21 days prior to the date established for the receipt of the bid. No substitutions will be considered after the date of the receipt of the bid or contract award unless there is cause for a substitution which complies in every respect to the provisions of the Contract Documents, Division 1. Substitution requests shall be made in accordance with Public Contracts Code (AB2084) revisions as follows:

- a. **No substitutions are allowed after bid opening.**
 - b. **All substitutions must be requested 21 days prior to bid opening date.**
 - c. **Final addendum naming approved substitutions of materials/equipment must be issued 7 days prior to bid date.**
- F. Record Drawings: Comply with Division 1. Keep up to date, monthly payments withheld if not updated.
- G. Shop Drawings and Submittals: Submittals on all material prior to installation.
1. Drawings shall be submitted, as required under Division 1.
 2. Shop drawings shall be submitted on, but not limited to, the following:
 - a. 16123 Building Wire and Cable
 - b. 16130 Boxes
 - c. 16140 Wiring Devices
 - d. 16160 Cabinets and Enclosures
 - e. 16426 Distribution Switchboards
 - f. 16440 Disconnect Switches
 - g. 16461 Dry Type Transformers
 - h. 16470 Panelboards
 - i. 16510 Interior & Exterior Luminaries
 - j. 16721 Fire Alarm System
 - k. 16750 Nurse Call System
 - l. 16760 Intercom System

t. 16781 Television Distribution System

- H. Trenching and Backfilling: All trenching and backfilling for electrical work shall be the responsibility of the contractor and shall be done in accordance with Division 2 of this specification. The Contractor shall examine the drawings of all other sections to determine locations of all existing underground lines. The Contractor shall use extreme caution when working in the vicinity of these lines and shall be responsible for the proper and approved repair of any damage caused by his work.
- I. Cutting and Patching:
1. Obtain written permission from the Architect before core drilling or cutting any structural members. Exact method and location of conduit penetrations and/or openings in concrete walls, floors, or ceilings shall be as approved by the Architect.
 2. All core drilling, cutting and patching for this work shall be performed under this Section of the specifications. Use craftsmen skilled in their respective sections for cutting, fitting, repairing, patching of plaster and finishing of materials including carpentry work, metal work or concrete work required for this Work. Do not weaken walls, partitions or floor with cutting. Holes required to be cut in floors must be drilled without excessive breaking out around the holes. Patching and/or refinishing shall be determined by the Architect.
 3. Use care in piercing waterproofing. After the part piercing the waterproofing has been set in place, seal openings and make absolutely watertight.
 4. Seal all openings to meet the fire rating of the particular wall floor or ceiling. Conform to Division 7.
 5. Conform to Division 1.

1.03 JOB CONDITIONS

- A. Existing Conditions:
1. The contractor shall visit the site and verify existing conditions. Where existing conditions differ from the drawings, adjustment shall be made and allowances included for all necessary equipment to complete all parts of the drawings and specifications.
 2. Electrical circuits affecting work shall be de-energized while working on or near them.
 3. Arrange the work so that electrical power is available to all electrical equipment within existing facility at all times. Schedule all interruptions at the convenience of the Owner, including exact time and duration.

Provide temporary power during all periods of interruption, which are deemed excessive by the Owner. Costs of all premium time (overtime) resulting from the scheduled power interruptions and all costs for providing temporary power shall be included in the cost of the Work.

B. Protection:

1. Protection of apparatus, materials and equipment. Take such precautions as necessary to properly protect all apparatus, fixtures, appliances, material, equipment and installations from damage of any kind. The Engineer may reject any particular piece or pieces of material, apparatus or equipment scratched, dented or otherwise damaged.
2. Seal equipment or components exposed to the weather and make watertight and insect proof. Protect equipment outlets and conduit openings with temporary plugs or caps at all times that work is not in progress.

C. Sequencing and Scheduling:

1. Work lines and established heights shall be in strict accordance with architectural drawings and specifications insofar as these drawings and specifications extend. Verify all dimensions shown and establish all elevations and detailed dimensions not shown.
2. Lay out and coordinate all work well enough in advance to avoid conflicts or interferences with other work in progress so that in case of interference the electrical layout may be altered to suit the conditions, prior to the installation of any work and without additional cost to the Owner. Conflicts arising from lack of coordination shall be this Contractor's responsibility. Maintain all code-required clearances about electrical equipment. Unless specifically noted otherwise, establish the exact location of electrical equipment based on the actual dimensions of equipment furnished.

1.04 WORK IN COOPERATION WITH OTHER SECTIONS

- A. Examine the drawings and specifications and determine the work to be performed by the electrical, mechanical and other sections. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, motor starters, disconnects, relays, time clocks and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment. Where a conflict occurs on drawings, the most stringent shall apply.
- B. Provide conduit and wire for all controls and other devices, both line and low voltage, described in this or other parts of the contract documents. Install all control housings and backboxes required for installing conduit and wire to the controls.

- C. Install control wiring in separate conduit between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify from the control manufacturer's shop drawings where these separate conduit runs are required.
- D. Plan all work so that it proceeds with a minimum of interference with other sections. Inform all parties concerned of openings required for equipment or conduit required in the building construction for Electrical Work and provide all special frames, sleeves and anchor bolts as required. Coordinate the electrical work with the mechanical installation. Promptly report to the Architect any delay or difficulties encountered in the installation of this work which might prevent prompt and proper installation, or make it unsuitable to connect with or receive the work of other sections. Failure to so report shall constitute an acceptance of the work of other sections as being fit and proper for the execution of this work.

1.05 TESTING AND ADJUSTMENT

- A. Upon completion of all Electrical Work, the contractor shall provide all testing as follows:
 - 1. Operational Test: Test all circuit breakers, receptacles, motors and all other electrical and communication equipment. Replace all faulty devices and equipment discovered during testing with new devices and equipment at no additional cost, and that part of the system (or devices or equipment) shall then be retested.
 - 2. Secondary Grounding Resistance: Perform ground continuity test between main ground system and equipment frame, system neutral and/or derived neutral point.
 - 3. Ground Fault System Test: Measure system neutral insulation resistances to ensure no shunt ground paths exist.
 - 4. All test procedure shall be performed by an independent testing firm.

1.06 MAINTENANCE, SERVICING AND INSTRUCTION MANUALS, AND WIRING DIAGRAMS

- A. Prior to substantial completion, the contractor shall submit 5 copies of operating and maintenance and servicing instructions, as well as an equal number of copies of complete wiring diagrams all neatly bound in hard cover 3-ring binders with table of contents and tabs for the following items or equipment: (See Division 1 - Operation and Maintenance Data):
 - 1. Section 16426 - Distribution Switchboards
 - 2. Section 16461 - Dry Type Transformers
 - 3. Section 16470 - Panelboards

4. Section 16721 - Fire Alarm Systems
 5. Section 166750 – Nurse Call system
 6. Section 16760 – Intercom Systems
 7. Section 16781 – Television Distribution Systems
- B. All wiring diagrams shall specifically cover the installed system indicating zones, wiring, and components added to the system. Typical drawings will not be accepted.

1.07 FINAL INSPECTION AND ACCEPTANCE

- A. After all requirements of the specifications and/or the drawings have been fully completed, representatives of the Owner will inspect the Work. The Contractor shall provide competent personnel to demonstrate the operation of any item of system, to the full satisfaction of each representative. The Contractor shall provide 4 hours of minimum scheduled operation and maintenance training for school maintenance staff on each system indicated in 1.06A above. See specific sections for additional training/operation hours required for school personnel.
- B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.
- C. The Contractor shall furnish Record Drawings before final payment of retention.

END OF SECTION

SECTION 16111

CONDUIT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Metal conduit.
- B. Flexible metal conduit.
- C. Liquidtight flexible metal conduit.
- D. Electrical metallic tubing.
- E. Nonmetal conduit.
- F. Fittings and conduit bodies.

1.02 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI C80.5 - Rigid Aluminum Conduit.
- D. ANSI/NEMA FB 1-88 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- E. ANSI/NFPA 70 - National Electrical Code.
- F. NECA "Standard of Installation."
- G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.03 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70.
- B. All building raceway systems are to be "metal" and qualify as equipment grounding return path per NEC 517.13(A).

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Accurately record actual routing of conduits larger than 2 inches.

1.06 REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction] as suitable for purpose specified and shown.

1.07 FIELD SAMPLES

- A. Provide under provisions of Division 1.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site under provisions of Division 1.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.09 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Minimum Size: 3/4 inch unless otherwise specified.
- B. Underground Installations:
 - 1. More than Five Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit, concrete encased PVC Schedule 40 or as indicated on drawings.
 - 2. Within Five Feet from Foundation Wall: Use intermediate metal conduit, concrete encased PVC Schedule 40 or as indicated on drawings.
 - 3. In or Under Slab on Grade: Use rigid steel conduit, intermediate metal conduit, and plastic coated conduit and thickwall nonmetallic conduit.
 - 4. Minimum Size: 3/4 inch, unless otherwise noted.
- C. Outdoor Locations, Above Grade: Use rigid steel and aluminum conduit, and intermediate metal conduit for locations from finished grade to 10 feet above finished grade or electrical metallic tubing may be used for locations exceeding, 10 feet above grade as indicated on drawings.
- D. In Slab Above Grade:
 - 1. Conduit shall not be installed in any floor slabs.
- E. Wet and Damp Locations: Use rigid steel and aluminum conduit, intermediate metal conduit and electrical metallic tubing.
- F. Dry Locations:
 - 1. Concealed: Use rigid steel and aluminum conduit, intermediate metal conduit, and electrical metallic tubing.
 - 2. Exposed: Use rigid steel and aluminum conduit, intermediate metal conduit, and electrical metallic tubing and thickwall nonmetallic conduit.

2.02 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Rigid Aluminum Conduit: ANSI C80.5.
- C. Intermediate Metal Conduit (IMC): Rigid steel.
- D. Fittings and Conduit Bodies: ANSI/NEMA FB 1-88; all steel fittings.

2.03 PVC COATED METAL CONDUIT

- A. Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 mil thick.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1-88; steel fittings with external PVC coating to match conduit.

2.04 FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction.
- B. Fittings: ANSI/NEMA FB 1-88.
- C. Six (6) foot maximum length.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction with PVC jacket.
- B. Fittings: ANSI/NEMA FB 1-88.

2.06 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1-88; steel or malleable iron, compression indenter type.

2.07 NONMETALLIC CONDUIT

- A. Description: NEMA TC 2; Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install conduit in accordance with NECA "Standard of Installation."
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange supports to prevent misalignment during wiring installation.
- D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

- F. Fasten conduit supports to building structure and surfaces under provisions of Section 16190.
- G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports
- H. Do not attach conduit to ceiling support wires.
- I. Arrange conduit to maintain headroom and present neat appearance.
- J. Route conduit parallel and perpendicular to walls.
- K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- L. Route conduit under slab from point-to-point.
- M. Maintain adequate clearance between conduit and piping.
- N. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- O. Cut conduit square using saw or pipecutter; de-burr cut ends.
- P. Bring conduit to shoulder of fittings; fasten securely.
- Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- R. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- S. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 2-inch size.
- T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
- V. Provide suitable pull string in each empty conduit except sleeves and nipples.
- W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- X. Ground and bond conduit under provisions of Section 16170.

- Y. Identify conduit under provisions of Section 16195.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.
- B. Route conduits through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

END OF SECTION

SECTION 16114

CABLE TRAYS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cable trays and accessories.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ASTM A 123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
- C. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process.
- D. NEMA VE 1 - Metallic Cable Tray Systems.

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.
- C. Product Data: Provide data for fittings and accessories.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual routing of cable tray and locations of supports.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 LADDER-TYPE CABLE TRAY

- A. Description: NEMA VE 1, Class 20C ladder type tray.
- B. Material: Steel.
- C. Finish: ASTM A 123, hot dipped galvanized after fabrication.
- D. Inside Width: 24 inches. As indicated on drawings.
- E. Inside Depth: 4 inches. As indicated on drawings.
- F. Straight Section Rung Spacing: 9 inches on center. As indicated on drawings.
- G. Inside Radius of Fittings: 24 inches or as indicated on drawings.
- H. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- I. Covers: Flanged, solid raised cover.

2.02 WARNING SIGNS

- A. Engraved Nameplates: 3/4-inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install metallic cable tray in accordance with NEMA VE 1.
- C. Install fiberglass cable tray in accordance with NEMA FG 1.

- D. Support trays in accordance with Section 16190. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 8 feet maximum.
- E. Use expansion connectors where required.
- F. Ground and bond cable tray under provisions of Section 16170.
 - 1. Provide continuity between tray components.
 - 2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
 - 3. Provide 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component.
 - 4. Connections to tray may be made using mechanical or exothermic connectors.
- G. Install warning signs at 20-ft centers along cable tray, located to be visible.

END OF SECTION

SECTION 16123

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Building wire and cable.
- B. Wiring connectors and connections.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide for each cable assembly type.
- C. Test Reports: Indicate procedures and values obtained.
- D. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.04 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years documented experience.

1.05 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.06 FIELD SAMPLES

- A. Provide under provisions of Division 1.

1.07 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Aluminum conductors shall not be used.
- D. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- E. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.08 COORDINATION

- A. Coordinate Work under provisions of Division 1.
- B. Determine required separation between cable and other work.
- C. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.01 BUILDING WIRE AND CABLE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: ANSI/NFPA 70; Type THHN/THWN or XHHN insulation for feeders and branch circuits.

2.02 WIRING CONNECTORS

- A. Split Bolt Connectors:
- B. Solderless Pressure Connectors:
- C. Spring Wire Connectors:
- D. Compression Connectors:

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.

3.02 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.03 WIRING METHODS

- A. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN or XHHN insulation, in raceway.
- B. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN or XHHN insulation, in raceway.
- C. Above Accessible Ceilings: Use only building wire, Type THHN/THWN or XHHN insulation, in raceway.
- D. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN or XHHN insulation, in raceway.
- E. Exterior Locations: Use only building wire, Type XHHW insulation, in raceway.
- F. Underground Installations: Use only building wire, Type XHHW insulation, in raceway.
- G. Use wiring methods indicated on Drawings.

3.04 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- C. Use stranded conductors for control circuits.
- D. Use conductor not smaller than 12 AWG for power and lighting circuits.
- E. Use conductor not smaller than 16 AWG for control circuits.
- F. Use 10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.

- G. Use 10 AWG conductors for 20 ampere, 277-volt branch circuits longer than 200 feet.
- H. Pull all conductors into raceway at same time.
- I. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- J. Protect exposed cable from damage.
- K. Support cables above accessible ceiling, using spring metal clips or metal or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- L. Use suitable cable fittings and connectors.
- M. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- N. Clean conductor surfaces before installing lugs and connectors.
- O. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- P. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- Q. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- R. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.05 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Section 16195.
- B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.06 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Division 1.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

Riverside County – Volunteers in Medicine Clinic
82-915 Avenue 48
Indio, CA.
Project #0901.00

D. Verify continuity of each branch circuit conductor.

END OF SECTION

SECTION 16130

BOXES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Wall and ceiling outlet boxes.
- B. Floor boxes.
- C. Pull and junction boxes.

1.02 REFERENCES

- A. ANSI/NEMA FB 1-88 - Fittings and Supports for Conduit and Cable Association.
- B. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
- C. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.03 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Accurately records actual locations and mounting heights of outlet, pull and junction boxes.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.05 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Verify locations of floor boxes and outlets in offices and work areas prior to rough in.

- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include installation within 10 feet of location shown.

PART 2 - PRODUCTS

2.01 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2-inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
- B. Cast Boxes: NEMA FB 1, Type FD, aluminum or cast ferroalloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.02 FLOOR BOXES

- A. Floor Boxes: ANSI/NEMA OS 1, fully adjustable.
- B. Material: Cast metal.
- C. Shape: Round.
- D. Conform to regulatory requirements for concrete-tight floor boxes.

2.03 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.
- B. Surface-Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.
 - 1. Material: Galvanized cast iron or cast aluminum.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- C. In-Ground Cast Metal Boxes: NEMA 250; Type 6, inside flanged, recessed cover box for flush mounting.
 - 1. Material: Galvanized cast iron or cast aluminum.
 - 2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: ELECTRIC.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.
- B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Install pullboxes and junction boxes above accessible ceiling and in unfinished areas only.
- D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- E. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.
- F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- G. Use flush mounting outlet boxes in finished area.
- H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated walls.
- I. Secure flush mounting boxes to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- J. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- L. Use adjustable steel channel fasteners for hung ceiling outlet box.
- M. Do not fasten boxes to ceiling support wires.
- N. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits, both supported within 12 inches of box.
- O. Use gang boxes where more than one device is mounted together. Do not use sectional boxes.
- P. Use gang box with plaster ring for single device outlets.
- Q. Use cast outlet boxes in exterior locations exposed to the weather and wet locations.

- R. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- S. Set floor boxes level.
- T. Large Pullboxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
 - 1. Interior Dry Locations: Use hinged enclosure under provisions of Section 16160.
 - 2. Other Locations: Use surface-mounted cast metal box.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations and sizes of required access doors with Division 8.
- B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- C. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- D. Position outlets to locate luminaires as shown on reflected ceiling plans.

3.03 ADJUSTING

- A. Adjust floor box flush with finish flooring material.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closure in unused box opening.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Device plates and decorative box covers.

1.02 REFERENCES

- A. NECA - Standard of Installation.
- B. NEMA WD 1 - General Requirements for Wiring Devices.
- C. NEMA WD 6 - Wiring Device -- Dimensional Requirements.
- D. NFPA 70 - National Electrical Code.

1.03 SUBMITTALS FOR REVIEW

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.04 SUBMITTALS FOR INFORMATION

- A. Division 1 - Submittals: Submittals for information.
- B. Submit manufacturer's installation instructions.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.

- B. Provide Products listed and classified by Underwriters Laboratories, Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.07 EXTRA MATERIALS

- A. Furnish two of each style, size, and finish wall plate.

PART 2 - PRODUCTS

2.01 WALL SWITCHES

- A. Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.
- B. Body and Handle: White plastic with toggle handle.
- C. Ratings:
 - 1. Voltage: 120-277 volts, AC.
 - 2. Current: 20 amperes or match branch circuit and load characteristics.

2.02 WALL DIMMERS

- A. Manufacturers:
 - 1. Lutron #NTFTV-WH
- B. Description: NEMA WD 1; Electronic dimmer for LED lamps, Type as indicated on drawings.
- C. Body and Handle: White plastic with linear slide.
- D. Voltage: 0-10 volts.
- E. Power Rating: Match load shown on drawings; 16 AMPS maximum.

2.03 RECEPTACLES

- A. Description: NEMA WD 1, Heavy-duty hospital grade receptacle.
- B. Device Body: White plastic.
- C. Configuration: NEMA WD 6, type as specified and indicated.
- D. Convenience Receptacle: Type 5-20.
- E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

- F. Telephone Jack: RF45

2.04 WALL PLATES

- A. Decorative Cover Plate: White nylon smooth.
- B. Jumbo Cover Plate: White, nylon smooth.
- C. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Division 1 - Coordination and Meetings: Verification of existing conditions prior to beginning work.
- B. Verify that outlet boxes are installed at proper height.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.03 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmers.
- F. Install receptacles with grounding pole on top.
- G. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping conductor around screw terminal.
- J. Use jumbo size plates for outlets installed in masonry walls.
- K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.04 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights specified and indicated on drawings.
- B. Install wall switch 48 inches above finished floor to top of box.
- C. Install convenience receptacle 18 inches above finished floor to bottom of box.
- D. Install convenience receptacle 6 inches above counter or backsplash of counter.
- E. Install dimmer 48 inches above finished floor to top of box.
- F. Install telephone jack 18 inches above finished floor to top of box.
- G. Install telephone jack for side-reach wall telephone to position top of telephone at 48 inches above finished floor to top of box.
- H. Install telephone jack for forward-reach wall telephone to position top of telephone at 48 inches above finished floor to top of box.

3.05 FIELD QUALITY CONTROL

- A. Division 1 - Quality Control and Starting of Systems: Field inspection, testing, adjusting, and balancing.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify that each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.
- G. Verify that each telephone jack is properly connected and circuit is operational.

Riverside County – Volunteers in Medicine Clinic
82-915 Avenue 48
Indio, CA.
Project #0901.00

3.06 ADJUSTING

- A. Division 1 - Contract Closeout and Starting of Systems: Adjusting installed work.
- B. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

- A. Division 1 - Contract Closeout: Cleaning installed work.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 16160

CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Hinged cover enclosures.
- B. Cabinets.
- C. Terminal blocks.

1.02 REFERENCES

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.
- C. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide manufacturer's standard data for enclosures and cabinets.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.05 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.
- B. Provide four of each cabinet key.

PART 2 - PRODUCTS

2.01 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250, Type 1 for interior dry locations and 3R for other locations unless otherwise noted, steel enclosure.
- B. Covers: Continuous hinge, held closed by flush latch operable by key.
- C. Provide interior plywood panels for mounting terminal blocks and electrical components; finish with white enamel.
- D. Enclosure Finish: Manufacturer's standard enamel.

2.02 CABINETS

- A. Boxes: Galvanized steel with removable endwalls.
- B. Box Size: 24 inches wide by 30 inches high by 6 inches deep or as indicated on drawings.
- C. Backboard: Provide 3/4-inch thick plywood backboard for mounting terminal blocks. Paint matte white.
- D. Fronts: Steel, flush or surface type as indicated on drawings with concealed trim clamps, keyed to match branch circuit panelboard. Finish with gray baked enamel.
- E. Knockouts: As required for conduit entry.
- F. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring.

2.03 TERMINAL BLOCKS

- A. Terminal Blocks: ANSI/NEMA ICS 4.
- B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- D. Provide ground bus terminal block, with each connector bonded to enclosure.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify conditions under provisions of Division 1.
- B. Verify that surfaces are ready to receive Work.

3.02 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner.
- C. Install cabinet fronts plumb.

END OF SECTION

SECTION 16170

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

1.03 GROUNDING ELECTRODE SYSTEM

- A. Concrete-encased electrode.
- B. Rod electrode.

1.04 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 25 ohms.
- B. Submit under provisions of General section.
- C. Product Data: Provide data for grounding electrodes and connections.
- D. Test Reports: Indicate overall resistance to ground and resistance of each electrode.
- D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Accurately records actual locations of grounding electrodes.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 3/4 inch.
- C. Length: 10 feet.

2.02 MECHANICAL CONNECTORS

- A. Material: Bronze.

2.03 WIRE

- A. Material: Stranded copper.
- B. Foundation and Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

2.06 GROUNDING WELL COMPONENTS

- A. Well Pipe 8-inch diameter by 24-inch long concrete pipe with belled end.
- B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.

- C. Provide grounding well pipe with cover at each rod location. Install well pipes top flush with finished grade.
- D. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- E. Provide bonding to meet Regulatory Requirements.
- F. Bond together metal siding not attached to grounded structure; bond to ground.
- G. Bond together reinforcing steel and metal accessories in pool and fountain structures.
- H. Provide grounding and bonding in-patient care areas to meet requirements of NFPA 99 and ANSI/NFPA 70.
- I. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.03 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION

SECTION 16180

EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment specified under other sections.

1.02 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.
- C. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.05 COORDINATION

- A. Coordinate works under provisions of Division 1.
- B. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough in of electrical connections to coordinate with installation schedule for equipment.

- E. Sequence electrical connections to coordinate with start-up schedule for equipment.

PART 2 - PRODUCTS

2.01 CORDS AND CAPS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- C. Cord Construction: ANSI/NFPA 70, Type SO multiconductor flexible cord with identified equipment-grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify conditions under provisions of Division 1.
- B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- D. Provide receptacle outlet where connection with attachment plugs is indicated. Provide cord and cap where field-supplied attachment plug is indicated.
- E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- F. Install disconnect switches, controllers, control stations, and control devices as indicated.
- G. Modify equipment control wiring with terminal block jumpers as indicated.

Riverside County – Volunteers in Medicine Clinic
82-915 Avenue 48
Indio, CA.
Project #0901.00

- H. Provide interconnecting conduit and wiring between devices and equipment where indicated.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Conduit and equipment supports.
- B. Anchors and fasteners.

1.02 REFERENCES

- A. NECA - National Electrical Contractors Association.
- B. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide manufacturer's catalog data for fastening systems.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide adequate corrosion resistance.
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

C. Anchors and Fasteners:

1. Concrete Structural Elements: Use precast insert system, expansion anchors, powder-actuated anchors and preset inserts.
2. Steel Structural Elements: Use beams clamps with seismic safety strap, spring steel clips, steel ramset fasteners, and welded fasteners.
3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Use expansion anchors and preset inserts.
6. Sheet Metal: Use sheet metal screws.
7. Wood Elements: Use wood screws.

2.02 STEEL CHANNEL

- A. Description: Galvanized steel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Obtain permission from Architect before using powder-actuated anchors.
- F. Obtain permission from Architect before drilling or cutting structural members.
- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. In wet and damp locations uses steel channel supports to stand cabinets and panelboards one inch off wall.

Riverside County – Volunteers in Medicine Clinic
82-915 Avenue 48
Indio, CA.
Project #0901.00

- J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Wire and cable markers.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide catalog data for nameplates and markers.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.05 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.

PART 2 - PRODUCTS

2.01 NAMEPLATES

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

B. Locations:

1. Each electrical distribution and control equipment enclosure.
2. Communication cabinets.

C. Letter Size:

1. Use 1/8-inch letters for identifying individual equipment and loads.
2. Use 1/4-inch letters for identifying grouped equipment and loads.

2.02 WIRE MARKERS

A. Description: Tape, split sleeve, or tubing type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

2.03 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates.

3.02 APPLICATION

A. Install nameplate parallel to equipment lines.

B. Secure nameplate to equipment front using screws, or rivets.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

Riverside County – Volunteers in Medicine Clinic
82-915 Avenue 48
Indio, CA.
Project #0901.00

- D. Identify underground conduits using underground warning tape. Install one tape per trench at 6 inches below finished grade.

END OF SECTION

SECTION 16426

DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Main switchboard.
- B. Distribution switchboard.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ANSI/IEEE C12.1 - Code for Electricity Metering.
- C. ANSI C39.1 - Electrical Analog Indicating Instruments.
- D. ANSI C57.13 - Instrument Transformers.
- E. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
- F. NEMA KS 1 - Enclosed Switches.
- G. NEMA PB 2 - Deadfront Distribution Switchboards.
- H. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.
- C. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- D. Test Reports: Indicate results of factory production tests.

- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1.
- B. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- C. Accept switchboards on site. Inspect for damage.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with NEMA PB 2.1 and manufacturers written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Division 1.
- B. Provide two of each key.

1.09 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Square D, General Electric, Eaton, Siemens, RSE Sierra.
- B. Substitutions: Under provisions of Division 1.

2.02 SWITCHBOARD

- A. Description: NEMA PB 2 with electrical ratings and configurations as indicated.
- B. Main Section Devices: Individually mounted.
- C. Distribution Section Devices: Panel mounted.
- D. Bus Material: Copper, standard size.
- E. Bus Connections: Bolted, accessible from front for maintenance.
- F. Ground Bus: Extend length of switchboard.
- G. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- H. Main Circuit Breaker: Solid-state Molded Case Circuit Breakers: NEMA AB 1, provide with electronic sensing, timing and tripping circuits for adjustable current settings; ground fault trip; instantaneous trip; and adjustable short time trip. Provide stationary mounting. Provide ground fault sensing integral with circuit breaker. Provide zero sequence type ground fault sensors.
- I. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
- J. Ground Fault Sensor: Zero sequence type.
- K. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.
- L. Provide metering transformer compartment for Utility Company's use. Provide compartment size, bus spacing and drilling, door, and locking and sealing requirements.
- M. Pull Section: Size as shown on Drawings: Arrange as shown on Drawings.

- N. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- O. Enclosure: Type 1 - General Purpose.
 - 1. Align sections at front and rear.
 - 2. Switchboard Height: 92 inches, excluding floor sills and lifting members.
 - 3. Finish Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion resisting paint, or plate with cadmium or zinc.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify conditions under provisions of Division 1.
- B. Verify that surface is suitable for switchboard installation.

3.02 INSTALLATION

- A. Install switchboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.03 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
- C. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each, at test voltage of 1000 volts; minimum acceptable value for insulation resistance is 2 megohms.
- D. Check tightness of accessible bolted bus joints using calibrated torque wrench.

3.04 ADJUSTING

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections in accordance with manufacturer's instructions.

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82-915 Avenue 48
Indio, CA
Project #0901.00

- C. Adjust circuit breaker trip and time delay settings in the field to values as instructed by the Architect/Engineer.

3.05 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 16440

DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Disconnect switches.
- B. Fuses.
- C. Enclosures.

1.02 REFERENCES

- A. ANSI/UL 198C - High-Interrupting Capacity Fuses; Current Limiting Types.
- B. ANSI/UL 198E - Class R Fuses.
- C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses).
- D. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.
- E. NEMA KS 1 - Enclosed Switches.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - DISCONNECT SWITCHES

- A. Square D.
- B. Eaton.
- C. Siemens ITE.
- D. General Electric.

2.02 DISCONNECT SWITCHES

- A. Fusible Switch Assemblies: NEMA KS 1; FS W-S-865; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: FS W-F- 870.
- B. Nonfusible Switch Assemblies: NEMA KS 1; Type HD; FS W-S-865; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

- C. Enclosures: NEMA KS 1; Type 1, for interior dry locations; Type 3R for exterior or wet locations.
- D. Switch Ratings: Number of poles, voltage, current and horsepower rating as required for particular installation.

2.03 ACCEPTABLE MANUFACTURERS - FUSES

- A. Littelfuse.
- B. Gould Shawmut.
- C. Cooper Bussman.

2.04 FUSES

- A. Fuses 600 Amperes and Less: ANSI/UL 198C, Class J; ANSI/UL 198E, Class RK1; current limiting, one-time fuse, 250, 600 volt.
- B. Interrupting Rating: 200,000 rms amperes.
- C. Size fuses based on motor nameplate rating.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install disconnect switches where indicated on Drawings.
- B. Install fuses in fusible disconnect switches, otherwise required by Code.
- C. Properly align switches and support independent of the connecting raceway.

END OF SECTION

SECTION 16461

DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Dry type energy efficient transformers per NEMA TP1.

1.02 RELATED SECTIONS

- A. Section 16111 - Conduit: Flexible conduit connections.
- B. Section 16170 - Grounding and Bonding.
- C. Section 16190 - Supporting Devices.

1.03 REFERENCES

- A. NEMA ST 20 - Dry Type Transformers for General Applications.
- B. NFPA 70 - National Electrical Code.
- C. NEMA TP1.
- D. NEMA TP2

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.
- C. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA Standard of Installation.
- B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and shown.
- C. Transformers losses shall conform to NEMA TP1 regulations.
- D. Transformers losses shall be tested in accord with NEMA TP2 procedures.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect, and handle products to site under provisions of Division 1.
- B. Deliver transformers individually wrapped for protection and mounted on shipping skids.
- C. Accept transformers on site. Inspect for damage.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with manufacturers written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 DRY TYPE ENERGY EFFICIENT TRANSFORMER

- A. Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, ratings as indicated. Dry-type efficient transformers per NEMA TP1, with primary and secondary voltages of 600V and less and capacity ratings 15 kVA through 759 kVA.
- B. Insulation system and average winding temperature rise for rated KVA as follows:

1. 1-15 KVA: Class 185 with 80 degrees C rise.
 2. 16-500 KVA: Class 220 with 80 degrees C rise.
- C. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point.
- D. Transformers shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% OF FULL LOAD CAPACITY. Efficiency shall be tested in accord with NEMA TP2.
- E. Winding Taps:
1. Transformers Less than 15 KVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
 2. Transformers 15 KVA and Larger: NEMA ST 20.
- F. Sound Levels: NEMA ST 20.
- G. Basic Impulse Level: 10 KV. 10 KV for transformers less than 300 KVA, 30 KV for transformers 300 KVA and larger.
- H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- I. Mounting: Suitable for wall, floor, or trapeze mounting, except transformers larger than 75 KVA, suitable for floor or trapeze mounting.
- J. Coil Conductors: Continuous windings with terminations brazed or welded.
- K. Enclosure: NEMA ST 20; Type 1. Provide lifting eyes or brackets.
- L. Isolate core and coil from enclosure using vibration-absorbing mounts.
- M. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.02 SOURCE QUALITY CONTROL

- A. Provide testing of transformers under provisions of Division 1.
- B. Provide production testing of each unit in accordance with NEMA ST20.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify conditions under provisions of Division 1.
- B. Verify that surfaces are suitable for installing transformer supports.

3.02 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Set transformer plumb and level.
- C. Use flexible conduit, under the provisions of Section 16111, 2-ft minimum lengths, for connections to transformer case. Make conduit connections to side panel of enclosure.
- D. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- E. Provide seismic restraints.
- F. Provide grounding and bonding in accordance with Section 16170.

3.03 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Check for damage and tight connections prior to energizing transformer.
- C. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Distribution panelboards.
- B. Branch circuit panelboards.

1.02 RELATED SECTIONS

- A. Section 16190 - Supporting Devices.
- B. Section 16195 - Electrical Identification: Engraved nameplates.

1.03 REFERENCES

- A. NECA (National Electrical Contractors Association) "Standard of Installation."
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA KS 1 - Enclosed Switches.
- E. NEMA PB 1 - Panelboards.
- F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- G. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual locations of Products; indicate actual branch circuit arrangement.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.07 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA Standard of Installation.
- B. Maintain one copy of each document on site.

1.08 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

1.09 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.10 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings and instructed by manufacturer.

1.11 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Division 1.
- B. Provide two of each panelboard key.

1.12 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Square D, General Electric, Eaton, Siemens.
- B. Substitutions: Under provisions of Division 1.

2.02 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, circuit breaker type.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating: 14,000 amperes rms symmetrical for 240 volt panelboards; 22,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on drawings.
- D. Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- E. Provide circuit breaker accessory trip units and auxiliary switches as indicated.
- F. Enclosure: NEMA PB 1, Type 1. Cabinet box: 10 inches deep; width: 36 inches.
- G. Cabinet Front: Surface type, fastened with concealed trim clamps. Provide hinged door with flush lock. Finish in manufacturer's standard gray enamel.

2.03 BRANCH CIRCUIT PANELBOARDS

- A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1, circuit breaker type.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on drawings.
- D. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
- E. Enclosure: NEMA PB 1, Type 1.

- F. Cabinet box: 6 inches deep; width: 20 inches for 240 volt and less panelboards, 20 inches for 480 volt panelboards.
- G. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section 16190.
- C. Height: 6 ft to top of panelboard; install panelboards taller than 6 ft with bottom no more than 4 inches above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide engraved plastic nameplates under the provisions of Section 16195.
- G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.

END OF SECTION

SECTION 16510
INTERIOR LUMINAIRES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires and accessories.
- B. Exit signs.
- C. Ballasts.
- D. Fluorescent dimming ballasts and controls.
- E. Fluorescent lamp emergency power supply.
- F. Lamps.
- G. Luminaire accessories.

1.02 RELATED SECTIONS

- A. Section 16130 - Boxes.

1.03 REFERENCES

- A. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
- B. ANSI C82.1 - Ballasts for Fluorescent Lamps -Specifications.
- C. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).
- D. ANSI/NFPA 70 - National Electrical Code.
- E. ANSI/NFPA 101 - Life Safety Code.
- F. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.

- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.
- E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Accurately record actual locations of each luminaire.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Maintenance Data: Include replacement parts list.

1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.

1.08 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Conform to requirements of NFPA 101.
- C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.09 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.
- B. Provide two of each plastic lens.
- C. Provide one replacement lamp for each lamp installed.
- D. Provide two of each ballast type.

PART 2 - PRODUCTS

2.01 LUMINAIRES

- A. Furnish products as specified in schedule on Drawings.
- B. Substitutions: Under provisions of Division 1.
- C. Install ballasts, lamps, and specified accessories at factory.

2.02 EXIT SIGNS

- A. Manufacturers:
 - 1. See lighting fixture schedule on electrical drawings.
- B. Description: Exit sign fixture.
- C. Housing: Extruded aluminum.
- D. Face: Aluminum stencil face with red letters.
- E. Directional Arrows: Universal type for field adjustment.
- F. Mounting: Universal, for field selection.
- G. Battery: 12 volt, nickel-cadmium type, with 1.5-hour capacity.
- H. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.
- I. Lamps: Manufacturers standard.
- J. Input Voltage: 120/277 volts.

2.03 BALLASTS

- A. Fluorescent Ballast:
 - 1. Description: ANSI C82.1, high power factor type electromagnetic ballast.
 - 2. Provide ballast suitable for lamps specified.
 - 3. Voltage: Match luminaire voltage.
 - 4. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc.

2.04 FLUORESCENT DIMMING BALLASTS AND CONTROLS

- A. Control Unit: Linear slide type, rated 1500 watts at 120 or 277 volts as indicated on drawings.
- B. Dimming Ballast:
 - 1. Furnish dimming ballasts in specified luminaires.
 - 2. Use ballast selected by dimming system manufacturer as suitable for operation with control unit.
 - 3. Lamps: Suitable for lamp type and quantity specified for luminaire.

2.05 FLUORESCENT LAMP EMERGENCY POWER SUPPLY

- A. Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.
- B. Lamp Ratings: One F40CW lamp providing 1400 lumens, minimum.
- C. Battery: Sealed lead calcium type, rated for 10-year life.
- D. Include TEST switch and AC ON indicator light, installed to be operable and visible from the outside of an assembled luminaire.

2.06 LAMPS

- A. Provide lamp type specified for luminaire.
- B. Reflector Lamp Beam Patterns: ANSI C78.379.

2.07 ACCESSORIES

- A. Provide all required accessories such as sockets, glassware, boxes, spacers, mounting devices, etc.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrate and supporting grids for luminaires.
- B. Examine each luminaire to determine suitability for lamps specified.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- C. Support luminaires independent of ceiling framing.
- D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- F. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure and provide auxiliary members spanning ceiling Ts.
- G. Install recessed luminaires to permit removal from below.

- H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Install clips to secure recessed grid-supported luminaires in place.
- J. Install wall mounted luminaires and exit signs at height as indicated on Drawings.
- K. Install accessories furnished with each luminaire.
- L. Connect luminaires, emergency lighting units and exit signs to branch circuit outlets provided under Section 16130.
- M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- N. Bond products and metal accessories to branch circuit equipment grounding conductor.
- O. Install specified lamps in each luminaire.

3.03 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.04 ADJUSTING

- A. Adjust Work under provisions of Division 1.
- B. Aim and adjust luminaires as indicated on Drawings and as directed.
- C. Adjust exit sign directional arrows as indicated.
- D. Relamp luminaires that have failed lamps at Substantial Completion.

3.05 CLEANING

- A. Clean Work under provisions of Division 1.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosure.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.06 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 1.
- B. Provide minimum of two hours demonstration of luminaire operation.

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82-915 Avenue 48
Indio, CA.
Project #0901.00

END OF SECTION

SECTION 16721

FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm control panels.
- B. Manual fire alarm stations.
- C. Automatic smoke and heat detectors.
- D. Fire alarm signaling appliances.
- E. Auxiliary fire alarm equipment.

1.02 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NFPA 72 - Installation, Maintenance, and Use of Protective Signaling Systems.
- C. NFPA 72E - Automatic Fire Detectors.
- D. NFPA 72G - Notification Appliances for Protective Signaling Systems.
- E. NFPA 72H - Guide for Test Procedures for Protective Signaling Systems.
- F. NFPA 101 - Life Safety Code.

1.03 SYSTEM DESCRIPTION

- A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to central station.

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Provide annunciator layout and system wiring diagram showing each device and wiring connection required.
- C. Product Data: Provide electrical characteristics and connection requirements.
- D. Test Reports: Indicate satisfactory completion of required tests and inspections.

- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.5

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual locations of initiating devices, signaling appliances, and end-of-line devices.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Operation Data: Operating instructions.
- C. Maintenance Data: Maintenance and repair procedures.

1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in installing the products specified in this section with minimum five years documented experience, and certified by State of California as fire alarm installer.

1.08 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and NFPA 101.
- B. Furnish products listed and classified by UL and FM as suitable for purpose specified and indicated.

1.09 MAINTENANCE SERVICE

- A. Furnish service and maintenance of fire alarm system for one year from Date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.
- B. Provide ten manual station break-glass rods.
- C. Provide six keys of each type.
- D. Provide three of each type of automatic smoke detector.

PART 2 - PRODUCTS

2.01 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

- A. Control Panel: Modular construction with surface wall-mounted enclosure.
- B. Power supply: Adequate to serve control panel modules, remote detectors, remote annunciators, door holders, smoke dampers, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.
- C. System Supervision: Component or power supply failure places system in trouble mode.
- D. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from initiating an alarm.
- E. Indicating Appliance Circuits: Supervised march time signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from signaling an alarm.
- F. Remote Station Signal Transmitter: Electrically supervised digital alarm communicator transmitter, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.
- G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.
- H. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
- I. Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
 - 1. Visual and audible trouble alarm indicated by zone at fire alarm control panel.
 - 2. Visual and audible trouble alarm indicated at remote annunciator panel.
 - 3. Trouble signal transmitted to central station.
 - 4. Manual acknowledge function at fire alarm control panel silences audible trouble alarm; visual alarm is displayed until initiating failure or circuit trouble is cleared.
- J. Alarm Sequence of Operation: Actuation of initiating device places circuit in alarm mode, which causes the following system operations:

1. Sound and display local fire alarm signaling devices with march time signal.
 2. Transmit zone-coded signal to central station.
 3. Indicate location of alarm zone on fire alarm control panel and on remote annunciator panel.
 4. Transmit signal to building mechanical systems to initiate shutdown of fans and damper operation.
 5. Transmit signal to release door hold-open devices by zone.
- K. Alarm Reset: System remains in alarm mode until manually reset with key-accessible reset function; system resets only if initiating circuits are out of alarm mode.
- L. Lamp Test: Manual lamp test function causes alarm indication at each zone at fire alarm control panel and at annunciator panel.
- M. Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.
- N. Zoning: As indicated on drawings.

2.02 INITIATING DEVICES

- A. Manual Station: Semi-Flush mounted, coded type, double action manual station with break-glass rod. Provide manufacturer's standard backbox.
- B. Spot Heat Detector: Addressable Combination rate-of-rise and fixed temperature, rated 135 degrees F, and temperature rate of rise of 15 degrees F.
- C. Ceiling Mounted Smoke Detector: Addressable NFPA 72E, ionization type and photoelectric type with adjustable sensitivity, plug-in base, auxiliary relay contact and visual indication of detector actuation, suitable for mounting on 4 inch outlet box. Provide two-wire detector with common four-wire detector with separate power supply and signal circuits.
- D. Duct Mounted Smoke Detector: Addressable NFPA 72E, photoelectric type with auxiliary SPDT relay contact, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide two-- detector with common power supply and signal circuits.

2.04 SIGNALING APPLIANCES

- A. Alarm Lights: NFPA 72G, strobe lamp and flasher with red lettered "FIRE" on white lens.

- B. Chime: NFPA 72G, semi-flush, heavy duty, single stroke chime. Sound rating: 82 dB at ten feet; mount to 4-inch outlet box. Provide integral strobe lamp and flasher with red lettered "FIRE" on white lens.
- C. Remote Annunciator: Provide supervised remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in flush wall-mounted enclosure.

2.04 AUXILIARY DEVICES

- A. Door Release: Magnetic door holder with integral diodes to reduce buzzing. Coil voltage: 24 VDC.

2.05 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm Power Branch Circuits: Building wire as specified in Section 16123.
- B. Initiating Device and Indicating Appliance Circuits: Building wire as specified in Section 16123.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install manual station with operating handle 4 feet above floor. Install audible and visual signal device 7 feet 6 inches above floor.
- C. Use 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors. Install wiring in conduit.
- D. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.
- E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- F. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors.
- G. Automatic Detector Installation: Conform to NFPA 72E.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Test in accordance with NFPA 72H and local fire department requirements.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Division 1.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.04 FIRE ALARM WIRE AND CABLE COLOR CODE

- A. Provide fire alarm circuit conductors with insulation color-coded as follows, or using colored tape at each conductor termination and in each junction box.
- B. Power Branch Circuit Conductors: Black, red, and white.
- C. Initiating Device Circuit: Black, red.
- D. Detector Power Supply: Violet, brown.
- E. Signal Device Circuit: Blue (positive), white (negative).
- F. Door Release: Gray, gray.
- G. Municipal Trip Circuit: Orange, orange.
- H. Municipal Fire Alarm Loop: Black, white.

3.05 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 1.
- B. Demonstrate normal and abnormal modes of operation, and required responses to each.

END OF SECTION

SECTION 16726

INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install a complete 12VDC intrusion detection system. The Intrusion Detection system shall be microprocessor-based, network capable and complete with an integral DACT that is UL listed. The intrusion detection system shall be capable of providing, at a minimum, the following:
1. Intrusion Detection Control Panel
 - a. Integral Digital Alarm Communications Transmitter (DACT).
 - b. Network Interface capability via copper and/or fiber optic network.
 2. Addressable initiation devices
 3. Addressable control modules
 4. Notification Appliances
 5. Remote Power Supplies
 6. On-site or remote video monitoring
 7. Remote Access capability via LAN/WAN network
 8. Access Control System interface capability
 9. Fire Alarm System interface capability
- B. The Contractor shall furnish all labor, materials, appliances, tools, equipment, facilities transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the applicable Contract Drawings and/or specified herein.
1. This specification document provides the requirements for the installation, programming, and configuration of a complete Command Processor Panel. This system shall include, but not be limited to:
 - a. Control panel
 - b. System cabinet

- c. Power supply
 - d. Digital Signaling Line Circuits (SLC)
 - e. Notification Appliance Circuits (NAC)
 - f. Annunciator/keypad bus
 - g. Batteries
 - h. Wiring
 - i. Conduit
 - j. Associated peripheral devices
 - k. Other relevant components and accessories required to furnish and install a complete and operational addressable reporting Life Safety System.
- C. Any material and/or equipment necessary for the proper operation of the system, which is not specified or described herein, shall be deemed part of this Specification.
- D. The Addressable Intrusion Detection System specified herein shall be connected to a UL Listed Central Station monitoring company.
- 1. Contractor shall coordinate with the District/Owner or his representative to obtain a telephone line for offsite monitoring.
 - 2. The system supplier/installer shall provide Central Station Monitoring of the Intrusion Detection System for a period of one (1) year from the date of final inspection and IOR testing of the system. All costs for said monitoring contract shall be included in the bid.
- E. Contractor shall offer intrusion detection system inspection and maintenance contract.

1.02 QUALIFICATIONS

- A. Equipment:
- 1. This specification is based on the equipment of manufacturer(s) who have been approved by the Owner and the Manufacturer(s) herein named shall be considered as meeting the requirements of this specification.
 - 2. The equipment manufacturer shall be a United States manufacturer, who has been regularly engaged in the manufacture of intrusion detection systems for at least twenty-five (25) years.

- a. Manufacturer shall have a proven track record of forward and backward compatibility for a minimum of twenty (20) years for its product's auxiliary devices, including system keypads, annunciation devices, zone expansion modules, and addressable detection devices.
 - b. The manufacturer must also manufacture receiving equipment that is compatible with standard dial-up telephone lines and network monitoring equipment that is compatible with a LAN, WAN, and the Internet. The receiving equipment shall be capable of receiving all status and alarm messages generated by the system. The receiving equipment shall be capable of updating the panel operating program and the system date and time.
 3. Equipment provided for this project shall be the product of DMP (Digital Monitoring Products). No substitutions shall be approved.
 4. It is the Contractor's responsibility to meet the entire intent of these specifications. Deviations from the specified items shall be at the risk of the Contractor until the date of final acceptance by the Architect, Engineer and the Owner's representative. All costs for removal, relocation or replacement of a substituted item shall be at the risk of the Electrical Contractor.
 5. All equipment shall conform to applicable codes and ordinances.
 6. All equipment shall bear the label of a Nationally Recognized Testing Laboratory (NRTL) such as Intertek Testing Services NA, Inc. (ITSNA - formerly ETL) or Underwriters Laboratories Inc. (UL) and be listed by their re-examination service.
- B. System Supplier/Installer:
1. The system shall be provided and installed by the Manufacturer's Authorized Distributor who is trained and certified by the Manufacturer in the proper installation, programming, service and maintenance of the system.
 - a. The System Supplier/Installer shall submit qualification documentation, which shall include the following:
 - 1) The System Supplier/Installer shall provide proof of current status as the Manufacturer's Authorized Distributor.
 - 2) The System Supplier/Installer shall provide proof that a minimum of four (4) technicians have attended and completed all requirements and received certification from the manufacturer's installation and service school.

- 3) System Supplier/Installer shall provide a list of twenty (20) completed projects of equal scope, with associated Owner's Representative contact names and telephone numbers.
 - 4) The System Supplier/Installer shall hold a valid State of California Contractor's License, C-10.
 - 5) The System Supplier/Installer shall hold a valid State of California Alarm Company Operator License, ACO.
2. The System Supplier/Installer shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection, service and maintenance of the system. The System Supplier/Installer shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.
 3. The System Supplier/Installer shall be prepared to offer a service contract for the maintenance of the system beyond the warranty period.
 4. The System Supplier/Installer shall be an established intrusion detection systems contractor that has and currently maintains a locally run (within 50 miles of the job site) and operated business for at least twenty-five (25) years.
 5. The System Supplier/Installer shall designate one person to act as the project manager having total responsibility for communications and project technical integrity. This project manager shall have a minimum of three (3) years experience as a supervisor and installer of the systems specified herein.

1.03 RELATED SPECIFICATIONS

- A. The conditions of the General Contract (General, Supplementary, and other Conditions) and the Division 1 - General Requirements specifications are hereby made a part of this Section.
 1. Section 16010 – Basic Electrical Requirements
 2. Section 16123 – Building Wire and Cable
 3. Section 16130 – Boxes
 4. Section 16060 – Cabinets and Enclosures
- B. Related Work By Others:
 1. Reference Part 3, sub-section 3.01 of this specification.

1.04 APPLICABLE CODES & STANDARDS

- A. 2001 Building Standards Administrative Code, Part 1, Title 24, California Code of Regulations.
- B. 2001 California Building Code (CBC) Part 2, Title 24, California Code of Regulations (1997 Uniform Building Code, Volumes 1, 2 & 3 with 2001 California Amendments).
- C. 2004 California Electrical Code (CEC) Part 3, Title 24, California Code of Regulations (2002 National Electrical Code with 2001 California Amendments).
- D. 2001 California Fire Code (CFC) Part 9, Title 24, California Code of Regulations (2000 Uniform Fire Code with 2001 California Amendments).
- E. NFPA Standards:
 - 1. The intrusion detection system shall comply with the applicable provisions of the following current National Fire Protection Association (NFPA) standards:
 - a. NFPA 70, National Electric Code
 - b. NFPA 110, Standard for Emergency and Standby Power Systems
 - c. NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems
 - d. NFPA 780, Standard for the Installation of Lightning Protection Systems
- F. ADA - Americans with Disabilities Act
- G. CAC – California Administrative Code, Title 24
- H. U.L. Standards:
 - 1. The system shall comply with the applicable provisions of the following U.L. Standards:
 - a. UL 294, Standard for Access Control Systems Units
 - b. UL 609, Standard for Local Burglar Alarm Units and Systems
 - c. UL 634, Standard for Connectors and Switches for Use with Burglar-Alarm Systems
 - d. UL 636, Standard for Holdup Alarm Units and Systems
 - e. UL 639 Standard for Safety for Intrusion-Detection Units

- f. UL 681, Standard for the Installation and Classification of Burglar and Holdup Alarm Systems
- g. UL 1076, Standard for Proprietary Burglar Alarm Units and Systems
- h. UL 1610, Standard for Central Station Burglar Alarm Units
- i. UL 1635, Standard for Digital Alarm Communicator System Units
- j. UL 2044, Standard for Commercial Closed Circuit Television Equipment

1.05 SUBSTITUTIONS

- A. The Intrusion Detection System shall be DMP (Digital Monitoring Products) **AS PER OWNER STANDARDS**. No substitutions shall be approved.

1.06 SUBMITTALS

- A. Within thirty-five (35) calendar days after the date of the award of the contract, the Contractor shall submit to the Architect for review, five (5) copies of a complete Submittal Package. The Submittal Package shall consist of the following sections, with each section separated with index tabs.

- 1. Title Page:
 - a. Project Title
 - b. Project address
 - c. Architect's name and address
 - d. Contractor's name and address
- 2. Index of Submittal Contents: Each Section of the Submittal Package shall be numbered chronologically and shall be summarized in the Index.
- 3. Certifications:
 - a. Index of Certification Section Contents
 - b. Valid State of California Contractors License
 - c. Manufacturer's Certifications
 - 1) Authorized Distributor
 - 2) Factory Trained Technician

4. Project List:
 - a. A substantial list (minimum of 20) of completed projects equal in scope to that specified herein.
 - 1) Contact information shall be made available upon request.
5. Product Data:
 - a. Index of Equipment Data Sheets
 - b. Manufacturer's Data Sheets including cable types
 - c. Applicable Listings and Approvals

PART 2 - PRODUCTS

2.01 SYSTEM REQUIREMENTS

- A. Component Enclosure: Housings; power supply enclosures, terminal cabinets, control units, and other component housings, collectively referred to as enclosures shall be so formed and assembled as to be sturdy and rigid. If sheet steel is used in the fabrication of enclosures, it shall be not less than an 18 gauge door with a 20 gauge box frame. Where exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent ready removal. Doors having a latch edge length of less than 24 inches shall be provided with a single lock. Where the hinged door latch edge is 24 inches or more in length, doors shall be provided with three-point latching device with lock; or alternatively with two locks, one located near each end. For SCIF and High Security applications an attack proof enclosure with proper tamper UL listed for use with the XR500/XR500N/XR500E shall be used.
- B. Electronic Components:
 1. All system electronic components shall be solid-state type, mounted on printed circuit boards. Light duty relays and similar switching devices shall be solid-state type or electromechanical.
 2. The panel shall have an over current notification LED that lights when devices connected to the Keypad Bus and LX-Bus(es) draw more current than the panel is rated for. When the over current LED lights, the LX-Bus (es) and Keypad bus are shut down.
- C. Control Unit:
 1. The basic control panel shall provide:
 - a. Expansion to a total of at least 10,000 user codes with 99 user profile definitions.

- b. Sixteen (16) independent door/keypad addresses, each with four zones.
 - c. Twenty (20) Holiday Dates for custom holiday scheduling by area.
 - d. A total door access granted event buffer of at least 10,000 events.
 - e. Anti-passback access control selectable by area and user.
 - f. Four (4) shift schedules per area.
 - g. A total of at least 100 programmable output relay schedules.
 - h. Thirty-two (32) individual reporting areas.
 - i. Built-in bell and telephone line supervision.
2. The networked control panel shall provide:
- a. All of the above features.
 - b. Require two-man access code or credentials.
 - c. Support programming to require the same or different access code entered within a programmed delay time of 1 to 15 minutes after disarming before activating a silent ambush alarm.
 - d. Support area programming that disables schedule and time-of-day changes while system is armed so that area can only be disarmed during scheduled times.
3. The encrypted control panel shall provide:
- a. All of the basic and network features listed above.
 - b. Built-in Encrypted Alarm Router.
 - c. Certified operation that meets 128 Bit AES Rijndael Encryption communications.
 - d. Certified operation that meets SCIF (Sensitive Compartmented Information Facility) application needs.
 - e. Certified operation that meets NIST (National Institute of Standards and Technology) standards.
 - f. Certification that encrypted panel is capable of meeting DCID 6/9 standards.

2. The system shall include a provision for an automatic, daily, weekly, thirty (30) day, or up to sixty (60) day communication link test from the control panel installation site to the central station.
 3. The system shall include a provision for displaying the internal system power and wiring conditions. Internal monitors shall include the bell circuit, AC power, battery voltage level, charging voltage, panel box tamper, phone trouble line 1, phone trouble line 2, transmit trouble, and network trouble.
- G. **Serial Interface:** The control panel shall be capable of a serial interface to output information to a standard serial printer or serial interface to a communication port on a standard computer. Through control panel programming the system shall include a provision to allow the selection of which reports are to be output.
- H. **Power Supplies:**
1. Power supplies for the control unit shall operate from 120 VAC, supplied at the respective protected areas. Standby batteries shall be supplied to power the system in the event of a utility power failure. Batteries shall be sized to provide 105% capacity for eight hours. Standby batteries shall be sealed lead-acid. Power supplies shall be all Solid State.
 2. Controls shall be designed to maintain full battery charge when alternating current is available. Batteries shall be recharged to 85% capacity within 24 hours from battery use. The system shall be automatically transferred to battery power upon loss of alternating current power and return to alternating current power upon restoration. Intrusion alarms shall not be initiated during switch over; a signal shall be initiated upon failure of battery or alternating current power.
 3. Approved power supplies shall meet or exceed the following power supply model specifications:
 - a. UL Listed DMP 505-12: 12VDC 5 amp with transformer and enclosure.
 - b. UL Listed DMP 504-24: 24 VDC 4 amps with transformer and enclosure.
- I. **Software:**
1. The system shall interface with computer software with the capability to fully program the panel by connecting to the panel through:
 - a. Direct cable connection interface card
 - b. Receiver phone line connection
 - c. Standard phone line connection

- d. Ethernet network connection
 - e. Network connection across the Internet
 2. The system shall interface with computer software capable of locking down all controlled doors.
 3. The system shall interface with computer software capable of monitoring and logging all events.
 4. The system shall interface with computer software capable of exporting reports in the following file formats:
 - a. Excel spreadsheet (*.xls)
 - b. Rich Text (*.rtf)
 - c. Windows Metafile (*.wmf)
 - d. QuickReport (*.qrp)
 - e. Text (*.txt)
 - f. Comma-separated (*.csv)
 - g. HTML document (*.htm)
 5. The system shall interface with computer software capable of printing custom, filtered reports including:
 - a. All Events
 - b. Zone Action
 - c. Arming/Disarming
 - d. Area Late to Close
 - e. User Code Changes
 - f. Door Access Granted
 - g. Door Access Denied
 - h. Opening/Closing Schedule Changes
 - i. System Monitors
 - j. System Events

J. Integrated Intrusion Alarm and Access Control Operation:

1. **Access Authority Levels:** The system shall be capable of programming access credentials authority levels to check whether the user has access to a specific area and also has the authority to disarm or arm the area. If the user access credential has access and disarm/arm authority the system shall provide the user the option to disarm the area simultaneously upon opening the door, or to open the door and begin an entry delay timer. With the timer option the user then disarms the area using an intrusion control keypad inside the area. If the user only has access authority to the area and the area is in an armed condition, the user is denied access to the area.
2. **Door Open Schedule Override:** The system shall be capable of programming certain area doors to be scheduled to unlock and lock at specific times of the day or night. The lock/unlock function shall be capable of an override option depending upon the area armed/disarmed status. If the area remains in an armed status at the scheduled unlock time the armed status overrides the unlock schedule ensuring the doors remain locked and armed in situations where the business might open late, close early, is affected by inclement weather, or another emergency.
3. **Common Area:** The system shall be capable of programming a common area to be armed when the last area in the system is armed and disarmed when the first area in the system is disarmed. To ensure the common area works properly it shall not have any user codes assigned to the common area. The system shall also be capable of programming multiple common areas.
4. **Early Morning Ambush:**
 - a. The system shall be capable of programming an area to require two user codes be entered within a programmed number of minutes to prevent an ambush message from being sent to the Central Station Receiver. If both user codes are not entered within the time an ambush message is sent to the central station receiver.
 - b. Both user codes shall have the authority to disarm the specific area and must be entered at the same keypad or reader. The keypad shall not display any indication that the ambush timer is running.
 - c. The system shall be capable of programming an output to provide an external indicator that an ambush situation is taking place.
5. **Safe & Vault Operation:** The system shall be capable of being programmed to only be disarmed during scheduled times regardless of the authority level of any user code or user profile in the system. The schedule and time and date set for this area shall not be capable of being

changed while the area is armed. Zones assigned to Safe & Vault areas shall not be able to be bypassed or force armed.

6. Panic Button Summary Test:
 - a. The system shall have the ability to test panic buttons without sending a panic alarm to the Central Station Receiver.
 - b. The system shall also have the ability to send panic zone test verification and failure results to the Central Station Receiver.
 - c. During the test, each time a panic zone trips, the display number shall increment and the keypad buzzer sound for two seconds.
 - d. The number of panic zones tripped shall constantly display until the test ends or no panic zone activity has occurred for 20 minutes.
 - e. When the Panic Zone Test ends and a zone failed (did not trip) during the test, the keypad shall be able to display the zone name and number and have the buzzer sounds for one second. Additional zone failed zones shall display when a button is pressed.

K. False Alarm Reduction Features: The system shall be capable of providing false alarm reduction features, functions, capabilities, or processes that either require alarms be verified or potential alarms be corrected before a system or zone can be placed into an armed state.

2. Exit Error Alert and Reporting: The panel shall be able to provide an automatic function to prevent a false alarm from occurring if an exit door does not properly close after the system is armed.
3. Entry and Exit Delay Annunciation:
 - a. When arming, the system shall provide clear annunciation indicators to the user about the need to exit the premises prior to the exit delay time expiring.
 - b. When disarming, the system shall notify the user the need to disarm the system prior to the entry delay time expiring.
4. Remote Annunciation: The system shall be able to provide entry and exit delay time period notification. This notification can be from DMP keypads, remote annunciators, or bell tests.
5. Abort Reporting: The system shall be capable of sending an Abort report to the central station if the system is disarmed while the alarm is still sounding. The Abort report shall be sent *after* the alarm report to notify the central station that an authorized user has cancelled the alarm.

6. **System Testing:** The system shall offer testing features that are simple, quick, and complete and provide the highest measure of safety by ensuring that alarm conditions are detected and communicated to the proper authorities in a timely manner and on a regularly scheduled basis.
7. **Ambush Code:** The system shall offer ambush codes for those dangerous encounters where the user is instructed to either arm or disarm the system under threat of harm. The duress code shall disarm the system without giving local indication of an alarm that might put the user well-being in jeopardy.
8. **Two-Button Panic Feature:** The system shall support DMP keypads that provide the option to use only two-button panic codes. The user shall be required to press and hold two designated keys for approximately two seconds before the system generates a panic alarm.
9. **Fire Verify Zones:** The system shall support Fire Verify zones to help the panel verify the existence of an actual fire condition before it sends an alarm report to the central station. The Fire Verify zone shall require the panel to perform a Sensor Reset whenever a device connected to a Fire Verify zone initiates an alarm. This shall begin a verification period during which the panel waits for a second alarm initiation. If the original zone or any other Fire Verify zone on the panel initiates an alarm within the next 120 seconds, the panel shall recognize this as an actual alarm and send an alarm report to the central station.
10. **Cross-Zoning Protection:** The system shall support cross-zoning as a means of requiring two device trips to occur within a short period of time before sounding an alarm and sending an alarm report to the central station. Supported device trips shall be from one device that trips two times, or from two devices that each trip once.
11. **Swinger Zone Bypassing:** The system shall be capable of automatically bypassing a zone if it goes into an alarm or trouble condition a specified number of times within a one-hour period. The panel shall be able to track the number of times the zone trips while armed and compare that against a programmed number. When that number is reached, the panel shall be able to automatically bypass the zone. The panel shall be capable of resetting the zone when the area to which it is assigned disarms, is manually reset from the keypad or remotely, or remains normal for one hour.
12. **Recently Armed Report:** The system shall be capable sending a System Recently Armed report, along with a zone alarm report, to the central station any time an alarm occurs within five minutes of the system arming. The System Recently Armed report allows the central station operator to follow a "call the subscriber first" procedure instead of immediately dispatching the police to what could be a false alarm.

13. **Transmit Delay:** The system shall be capable of programming the panel to wait up to 60 seconds before sending burglary alarm reports to the central station. If an alarm is accidental, the user shall be able to disarm the system within the programmed Transmit Delay time. An Abort report shall be sent in place of an alarm report after the system disarms. During the alarm, sirens and panel relay outputs shall not be delayed and shall still provide local condition annunciation.
14. **Call Waiting Cancel:** The system shall be capable of being programmed to cancel call waiting any time the panel dials the receiver number to send a report.

2.02 SYSTEM CAPABILITIES

A. System Description:

1. The system user shall be capable of selectively arming and disarming any one or more of 32 areas within the intrusion detection system based on the user PIN code and/or keypad used. Each of the 574 zones shall be able to be assigned to any of the 32 available areas. The system shall be capable of having up to a sixteen (16) character length name programmed for each area.
2. The system user shall be capable of assigning an opening and closing schedule to all areas or to each of the 32 areas separately. Each area shall be able to arm or disarm automatically by a schedule. The system shall have the capacity for common areas that automatically disarm when any other area disarms and that automatically arm when all others areas arm.
3. The networked system shall have the ability to comply with Safe & Vault application. The networked system shall also have the ability to use a two-man rule for disarming or allowing door access to an area. The system shall have the ability to operate a Common Area application.
4. The system shall have a minimum of eight (8) grounded burglary zones available from the control panel.
5. The system areas and zones shall be programmable, and the system shall store, log, display, and transmit specific custom designations for system areas, zones, and user names.
6. To ensure continued, one-call support, the system shall be constructed of sensing components provided directly by the system manufacturer, such as power supplies, motion detectors, door and window position switches, glass break detectors, or other sensing devices that the manufacturer offers.
7. The system controller, user interfaces, zone input devices, relay output devices, and the system signal receiving equipment shall be engineered,

manufactured, assembled, and must be distributed from a location within the United States of America.

8. The system shall support user interaction by way of a keypad, web browser, system software, key switch, or radio frequency wireless control, using integrated or auxiliary devices provided by the system manufacturer.
9. The system shall support controller zone input connections, system keypads, system zone expansion modules, and wireless zone input modules, and must support zone input connections by way of at least two competitive products. The system shall offer a seamless integrated compatibility with hard-wire and/ or wireless zone expansion equipment for at least 200 wireless zones and/ or a maximum of 574 hardwired zones.
10. The system shall be capable of offering at least five zone expansion buses, each of which can support the connection of up to 15,000 feet of four-wire cable. Zone expansion and keypad data buses that exceed 2,500 feet of cable must include splitter/repeater modules to boost data voltage and maintain data integrity.
11. The system shall provide a seamless capability to provide a minimum of 500 addressable relays, which can be located at any connection location upon a zone expansion bus.
12. System relay outputs shall have the capability of being triggered as a result of a command from the user interface, changes in system status, changes in zone status, or by a programmable schedule.
13. System relay output states shall be programmable for momentary, maintained, pulsed, or must follow the state of an associated system zone input.
14. The system shall be completely programmable either locally from a keypad or remotely through a standard dial-up, and network connections by way of a LAN, WAN, and/or by way of the Internet.
15. The control unit shall be completely programmable remotely using remote annunciators, and/ or using upload/ download software that communicates using SDLC 300 baud, 2400 baud, or IP Addressed data network. On-site programming from a personal computer shall also be permitted.
16. The control unit shall be equipped with an anti-reversing circuit breaker to prevent damage due to accidental reversal of battery leads.

B. Input/Output Capacity:

1. This system shall be capable of monitoring a maximum of 574 individual zones and controlling a maximum of 502 output relays.
2. The control panel shall have, as an integral part of the assembly, 2 SPDT Form C relays rated at 1 Amp at 30 VDC and four open collector 12 VDC outputs rated at 50mA each. It shall also have the capacity of a maximum of 125 output expander modules with 500 switched ground, open collector outputs, 50mA maximum and 502 auxiliary relays (Form C rated at 1.0 Amp at 30 VDC).
3. The panel shall also provide 100 programmable output schedules, and include an integral bell alarm circuit providing at least 1.5 Amps of steady, pulsed, or temporal bell output. Output type shall be programmable by zone type. Relays and voltage outputs shall be capable of being independently programmed to turn on and/or off at selected times each day.

C. User/Authorization Level Capacity:

1. The system shall be capable of operation by 10,000 unique Personal Identification Number (PIN) codes with each code having one (1) of ninety-nine (99) custom user profiles. This allows for limitation of certain functions to authorized users. The operation of all keypads shall be limited to authorized users.

D. Keypads:

1. The system shall support a maximum of sixteen (16) keypads with alphanumeric display. Each keypad shall be capable of arming and disarming any system area based on a pass code or Proximity key authorization. The keypad alphanumeric display shall provide complete prompt messages during all stages of operation and system programming and display all relevant operating and test data.
2. Communication between the control panel and all keypads and zone expanders shall be multiplexed over a non-shielded multi-conductor cable, as recommended by the manufacturer. This cable shall also provide the power to all keypads, zone expanders, output expanders, and other power consuming detection devices.
3. If at any time a keypad does not detect polling, the alphanumeric display shall indicate "SYSTEM TROUBLE". If at any time two devices are programmed for the same address, the alphanumeric keypad shall display "4 WIRE BUS TROUBLE". If at any time a keypad detects polling but not for its particular address, the alphanumeric display shall indicate "NON POLLED ADDR". The system shall display all system troubles at selected keypads with distinct alphanumeric messages.

4. The keypad shall include self-test diagnostics enabling the installer to test all keypad functions: display test, key test, zone test, LED test, relay test, tone test, and address test.
5. The keypad shall provide an easy-to-read English text display. The text shall exactly match the text seen in all software reports, keypad displays, and central station reports.
6. The keypad user interface shall be a simple-to-use, menu-driven help system that is completely user friendly.
7. The control panel shall support a keypad interface accessible on the World Wide Web in a browser window. The web-accessible keypad interface shall provide at least five (5) programmable hyperlinks for camera access or other use.
8. The system shall support sub-control keypads with four (4) built-in zones and capable of functioning in the following modes:
 - a. Panel monitors all four (4) keypad zones independently with a maximum of 125 keypads attached to the control panel
 - b. Panel assigns one (1) zone to each keypad and monitors all keypad zones as a single zone with a maximum of 500 keypads attached to the control panel
 - c. Stand-alone mode allowing keypad to operate as a self-contained security system independent of the control panel

E. Zone Configuration:

1. A minimum of 4 Class B ungrounded zones shall be available at each keypad or zone expander on the system. The system shall have the capacity for a maximum of sixteen (16) keypads and a maximum of 125 four (4) zone expanders or 500 single zone expanders. It shall also have the capacity of a maximum of 125 supervised relay output expanders. All Class B zones shall be 2-wire, 22 AWG minimum, supervised by an end-of-line (EOL) device and shall be able to detect open and short conditions in excess of 500ms duration.
2. Each zone shall function in any of the following configurations: Night, Day, Exit, Fire, Supervisory, Emergency, Panic, Auxiliary 1, Auxiliary 2, Fire Verification, Cross Zone, Priority, and Key Switch Arming.
3. The digital SLCs and the annunciator/keypad bus shall be able to operate at a maximum wiring distance of 2500 feet from the control panel on unshielded, non-twisted cable. This distance may be extended to a total of 15,000 feet when bus repeater modules are installed.

4. The system shall have the capability to incorporate up to 200 zone expander POPIT™ points.
5. Each zone shall function in any of the following configurations:
 - a. Night
 - b. Day
 - c. Exit
 - d. Fire
 - e. Supervisory
 - f. Emergency
 - g. Panic
 - h. Auxiliary 1
 - i. Auxiliary 2
 - j. Fire Verification
 - k. Cross-Zone
 - l. Priority
 - m. Arming

F. Communication:

1. The system shall be capable of signaling to two remote monitoring station receivers, four telephone numbers of 32 digits each using two separate switched telephone network lines such that if two unsuccessful attempts are made on the first line to the first number, the system shall make two attempts on first line to the second number. If these two attempts are unsuccessful, the system shall make two further attempts on the first line of the first number. After the tenth unsuccessful attempt, dialing shall stop and the alphanumeric keypad shall display trouble. Should another event occur that requires a report to be transmitted, the dialing process shall be repeated. The system shall have a programmable option to dial a second set of telephone numbers after the first ten attempts using the same sequence.
2. The system shall be capable of communication using the IBM Synchronous Data Link Control format, and at least two other standard industry formats.

3. The system shall be capable of supporting Network communication with digital dialer backup, existing Ethernet or token ring data networks, satellite communication, fiber optic networks, local area networks, wide area networks, cellular communication, and retail data networks.

G. Network Communication:

1. The control panel shall be capable of asynchronous network communication with a retry time between 3 and 15 seconds for a total of one (1) minute. If communication is unsuccessful the control panel shall be capable of attempting backup communication through any of the available communication methods to the same receiver or a backup receiver.
2. Network communication between the control panel and the receiver shall be in a proprietary communication format.
3. The control panel shall be capable of supporting Dynamic Host Communication Protocol (DHCP) Internet Protocol (IP) addressing.
4. Underwriters Laboratories (UL) shall list network communication by the control panel for Grade AA High-Line Security.
5. The control panel shall be capable of two-way network communication using standard Ethernet 10BaseT in a LAN, WAN, or Internet configuration.
6. The control panel shall be capable of communication by means of a 128 Bit AES Rijndael Encryption process certified by NIST (National Institute of Standards and Technology) to an SCS-1R receiver with a built-in Encryption Alarm Router.
7. The control panel shall be capable of meeting DCID 6/9 and UL 2050 standards.

H. TCP/IP Network Trapping:

1. The control panel shall be capable of having communication set to Network operation. When a trap is set in Remote Link, the software shall be capable of sending a panel trap message with the panel account number to the iCOM or iCOM-E installed in an SCS-1R receiver.
2. The receiver iCOM or iCOM-E shall store the trap and monitor the panel for the next message. When the panel sends its next message, the receiver iCOM or iCOM-E shall then send a message to the panel to contact Remote Link at the IP address contained in the original trap message.
3. The trap message shall be stored in the receiver iCOM or iCOM-E for up to four hours. If the trap message is not sent to the panel within the four-

hour window, the panel trap message shall be discarded and a new trap message must be sent from Remote Link.

4. The user shall be able to view the trap status in the receiver iCOM or iCOM-E in Remote Link using the Trap Query function.

I. NAC Circuit Configuration:

1. The system shall be capable of additional Class B NAC circuits utilizing the Model 867 Notification Module. Each module shall be controlled and supervised via the SLC loop and monitor for short circuits, open circuits, and ground faults. The NAC circuits shall monitor for external NAC trouble conditions.
2. The system shall be capable of providing Class A NAC circuits utilizing the Model 865 Notification Module. Each module shall monitor for short circuits, open circuits, and ground faults. The NAC circuits shall monitor for external NAC trouble conditions and have a manual bell silence switch.

2.03 SYSTEM COMPONENTS

A. Head End Equipment:

1. Intrusion Alarm Control Panel:
 - a. DMP - Model No. XR500L-G:
 - 1) Complete with large enclosure
 - 2) Complete with Dialer
 - 3) Quantity of (1) one required.
2. Network Interface Adaptor:
 - a. DMP - Model No. 462N:
 - 1) Quantity of (1) one required
3. Zone Expansion Interface Card:
 - a. DMP - Model No. 481:
 - 1) Quantity of (1) one required
4. Expansion Bus Adaptor:
 - a. DMP - Model No. 461:

- 1) Quantity of (1) per 100 points
- 2) Maximum of (5) five per Control Panel

B. LCD Keypad:

1. DMP - Model No. 790-I:
 - a. Built-in multi-tone sounder. Displays status in custom English text on 16-character display.
 - b. The intrusion alarm system shall be designed to include a predetermined time delay between entry and alarm. Operation of the keypad shall abort the alarm condition and disable the system until re-armed.
 - c. During an alarm condition, the alphanumeric readout on the keypad shall indicate, by room name and number, the location of the alarm.
 - d. Quantity as indicated on plans.
 - e. Maximum of (16) sixteen

C. Remote Power Supplies:

1. Altronix – Model No. SMP3:
 - a. Power supply for passive infrared detectors, 12VDC provide one in each building. Provide power supply, terminal cabinet, transformer and battery as required for a complete and operable system.
 - 1) Terminal cabinet enclosure
 - a) Mier Products, Inc. – Model No. MIPW108
 - 2) Transformer 120VAC-12VDC
 - a) DSC - Model No. DSCPTC1640U
 - 3) Battery
 - a) Yuasa – Model No. NP7-12

D. Data Bus Splitter/Repeater:

1. DMP – Model No. 710

- a. Expands the typical LX-Bus installation number of devices and the length of the wire.
 - b. Quantity as required.
- E. Single Point Zone Expander:
 - 1. DMP - Model No. 711:
 - a. The single point zone expander module serves as the interface between the two wire addressable data loop from the control panel and the conventional initiation devices (i.e. motion sensors and door switches).
 - b. Maximum of 574 single point zone expander modules can be connected to a XR500L-G type control panel.
- F. Motion Sensors – Passive Infrared (PIR):
 - 1. Bosch/Detection Systems – Model No. DS9360:
 - a. Ceiling mount (PIR) passive infrared/microwave motion sensor
 - b. 360 degree X 60' diameter pattern
 - c. Locate motion sensors as indicated on plans.
 - d. Connect to two wire data loop via 711 module
 - 2. Dual-Tec – Model No. DT-7450
 - a. Surface wall mount (PIR) passive infrared motion sensor
 - b. 50' x 60' range
 - c. Locate motion sensors as indicated on plans.
 - d. Connect to two wire data loop via 711 module
- G. Magnetic Door Switch:
 - 1. Sentrol – Model No. 1078W:
 - a. Door magnetic switches shall be mounted flush in door jam at locations as indicated on plans
 - b. Locate switches as indicated on plans.
 - c. Connect to two wire data loop via 711 module

H. Armored Door Switch:

1. Sentrol – Model No. 2505A:
 - a. Surface mount switch shall be utilized for roof hatches
 - b. Locate switches as indicated on plans.
 - c. Connect to two wire data loop via 711 module

I. Siren:

1. ATW Security – Model No. DS-301SET:
 - a. 25 watt siren in indoor/outdoor stainless steel enclosure

J. Wire/Cable:

1. Interior:
 - a. Belden - Model No. 5402UE
 - 1) 20/4 stranded CMR with gray jacket
2. Underground:
 - a. Belden – Model No. 27600A
 - 1) 20/3 pair stranded CMR with black wet location jacket

PART 3 - EXECUTION

3.01 DIVISION OF WORK

- A. While all work included under this specification is the complete responsibility of the contractor, the division of actual work listed following shall occur.
1. All conduits with pull cords, all electrical pull boxes, grounding rods, all outlet boxes, terminal cabinets, backboards, etc., which form part of the rough-in work shall be provided and installed completely by the Division 16 Contractor. Coordinate as necessary for proper installation.
 2. The balance of the system, including installation of initiating devices, notification appliances and equipment, making all connections, etc., shall be performed by the System Supplier/Installer.
 3. All 120VAC power conductors and conduits associated with power circuits to all low voltage system equipment locations shall be provided and installed by the Division 16 Contractor.

4. An insulated stranded copper ground wire shall be provided from each control unit to the building grounding system, in compliance with CEC Article 250, by the Division 16 Contractor.
5. Labeling of pullboxes and terminal cabinets shall be provided and installed by the Division 16 Contractor.

3.02 INSTALLATION

- A. All work shall be completed in strict accordance with all applicable codes and ordinances, by a qualified Manufacturer's Authorized Distributor.
- B. Cable/Wire:
 1. All cable/wire for the system specified herein shall be new, unless otherwise noted on plans.
 2. System cable/wire and equipment installation shall be in accordance with good engineering practices as established by the California Electrical Code (CEC). Wiring shall meet all applicable electrical codes. All cable/wire shall test free from all grounds and shorts.
 3. All cable/wire shall be labeled at all points of termination. All labeling shall be based on the room numbers as provided by the District/Owner or his representative.
 4. Protection and dressing of cables: Cables mounted on backboards and within equipment racks, etc., shall be grouped and securely attached to the backboard or enclosure in horizontal and vertical bundles in a neat workmanlike manner using Thomas & Betts "Ty-Rap", Panduit cable mounts and Allen-Tel cable management or equal. Edge protection material ("cat-track") shall be installed on edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edge.
 5. Shielding: Cable shielding shall be connected to common ground at the main control unit terminal board and shall be free from ground at any other point within the system. Cable shields shall be terminated in same manner as conductors.
 6. Underground cables: Any cable/wire pulled through manholes or pullboxes located below grade, shall be continuous with no splices. The cable/wire shall be intact with no cuts in the protective outer jacket.

3.03 SYSTEM START-UP

- A. All start-up programming and system commissioning shall be performed by a manufacturer's trained and certified technician.

3.04 SYSTEM VERIFICATION

- A. Subsequent to system start-up the system installer shall perform a pre-test to verify that the following features are functioning properly.
 - 1. All notification appliances
 - 2. All initiation devices
 - 3. All control modules
 - 4. All monitor modules
 - 5. Communication link to monitoring service

3.05 ACCEPTANCE TESTING

- A. The system installer shall, in the presence of the Inspector of Record (IOR), perform 100% testing as noted in System Verification above.

3.06 IN SERVICE TRAINING

- A. The Contractor shall instruct personnel designated by the District/Owner in the proper use, basic care and maintenance of the system beyond the warranty period. Contractor shall provide up to eight hours of in-service training with this system.

3.07 FACTORY TRAINING & CERTIFICATION

- A. The manufacturer shall provide factory certified training to two (2) technicians from the District/Owner. These technicians shall be trained and certified as manufacturers certified technicians capable of performing any work on the system after the installation of the system.
- B. All cost for training including travel, lodging, meals and per diem shall be included in the System Supplier/Installer's bid for this project.

3.08 CONTRACT CLOSE-OUT DOCUMENTATION

- A. Contractor shall provide the following:
 - 1. One reproducible hard copy of project record drawings.
 - 2. One copy of manufacturer's maintenance and operation manuals.
 - 3. One copy of system warranty

Riverside County – Volunteers in Medicine Clinic
82-915 Avenue 48
Indio, CA.
Project #0901.00

3.09 WARRANTY

- A. The Contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from the date of installation, repair or replace any equipment found to be defective. This warranty shall not apply to any equipment that has been subject to misuse, abuse, negligence or unauthorized modification.

END OF SECTION

SECTION 16750
NURSE CALL SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Nurse call master station.
- B. Central control and power supply equipment.
- C. Call stations.
- D. Accessories.

1.02 RELATED SECTIONS

- A. Section 16123 - Building Wire and Cable.

1.03 REFERENCES

- A. NFPA 70 - National Electrical Code.

1.04 SYSTEM DESCRIPTION

- A. System Features:
 - 1. Two-way communication between master station and patient, emergency, staff, and duty stations.
 - 2. Audible and visual annunciation of calls to master station.
- B. System Capacity:
 - 1. Conversation Paths: Two for each master.
 - 2. Call stations on each master may call simultaneously, without interference.
- C. System Configuration:
 - 1. Nurse Stations: Master station at each indicated nurse station receives calls from patient rooms and ancillary areas for that portion of floor including CODE BLUE calls.
 - 2. Patient Rooms and Wards: Single or dual patient station at each patient bed, set for medical status of patient.
 - 3. Patient Lavatories: Emergency station at each location.

4. Examination Rooms : Staff station with staff assist calling to provide normal emergency status calls and CODE BLUE station at each location.
5. Linen Rooms, Nurse Offices : Duty station at each location.

D. Calling Sequence of Operation:

1. Patient Station Calls: Initiate call manually using call cord switch, or automatically if call cord is removed from station. Medical status of call pre-set at master station.
2. Staff Station Calls: Initiate call manually with call switch. Medical status of call pre-set at master station.
3. Duty station Calls: Initiate staff status call manually with call switch.
4. Emergency Station Calls: Initiate emergency status call manually with call switch.
5. Staff Assist Station Calls: Initiate staff assist status call manually with call switch.
6. Master Station Calls: Establish two-way voice communication to selected patient, staff, or duty call stations; or staff status calls to other master stations manually using call switch.

E. Annunciation Sequence of Operation:

1. Call Annunciation at Master Station and Remote Annunciator: Indicate each call and its medical status from other master station and patient, staff assist, emergency, staff, CODE BLUE, and duty call stations visually with digital display of room number and audibly with tone.
2. Call Annunciation at Duty Station: Indicate each call and its status from patient, staff assist, emergency, staff, and duty stations visually with single annunciator lamp and audibly with tone.
3. Call Annunciation at Staff Assist Master Station: Indicate each call from staff assist and CODE BLUE stations visually with individual annunciator lamp and audibly with tone.
4. Call Annunciation at Patient Stations: Signal light indication of room activity monitoring from master station.
5. Patient Signal Lights: Indicate each patient station call and its status. Indicate reminder status by lighting corridor signal light outside selected room.
6. Zone Signal Lights: Indicate patient calls within each zone.
7. CODE BLUE Signal Lights: Indicate CODE BLUE calls within each zone.

8. System Monitor Calls at Patient Stations: When enabled at individual patient stations, system calls announce at that patient station.
9. Digital Page: Automatic signal indicates each call and its status to remote personal receivers.

F. Call Status Annunciation:

1. Normal Status Calls: Use steady white lamps and slow-rate repeating tones until answered; cancel call automatically when answered from master station, or manually from calling station.
2. Priority Status Calls: Use flashing lamps and fast-rate repeating tones until answered; cancel call manually from calling station.
3. Emergency Status Calls: Use flashing red lamps, and fast-rate repetitive tone until answered; cancel call manually from calling station.
4. Staff Assist Calls: Use flashing red lamps, and fast-rate repetitive tone until answered; cancel call manually from calling station.
5. Staff Status Calls: Provide two levels. Use steady lamps and slow-rate repeating tones until answered; cancel call automatically when answered from master station, or manually from calling station.
6. Call Reminder: Use flashing green lamps; cancel reminder manually from selected patient station.
7. CODE BLUE Calls: Use flashing blue lamp and high-rate repetitive tone; cancel call manually from calling station.

G. Intercom Sequence of Operation:

1. Each master selects any other master, any patient, staff, or duty call station or zone of call stations for two-way communication.
2. Each patient station, duty station, and staff station may initiate PRIVACY, disabling the master station's ability to monitor its activity.
3. Staff assist status call automatically establishes two-way communication between calling station and staff assists master station.

1.05 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements; cable routing; connection diagrams; and equipment arrangement.
- C. Product Data: Provide showing electrical characteristics and connection requirements.

- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual locations of each item of equipment, and show interconnecting wiring.

1.07 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Operation Data: Operator instructions for each required mode of operation.
- C. Maintenance Data: Routine troubleshooting procedures, manufacturer's operation and maintenance manual for each item of equipment and accessory, and routine cleaning methods and materials.

1.08 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Supplier: Authorized Franchised distributor of specified manufacturer with minimum five years documented experience.
- C. Installer: Authorized Franchised installer of specified manufacturer.

1.09 REGULATORY REQUIREMENTS

- A. Conform to applicable code for nurse call systems.
- B. Conform to requirements of NFPA 70.
- C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.10 MAINTENANCE SERVICE

- A. Furnish service and maintenance of nurse call system for one year from Date of Substantial Completion.

1.11 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.

- B. Provide two nurse call keys.
- C. Provide two patient call cords.
- D. Provide two dummy plugs.

PART 2 - PRODUCTS

2.01 MASTER STATION

- A. Description: Desk-mounted master nurse call unit.
- B. Speaker Sensitivity: 92-dB/watt input.
- C. Handset: Standard molded plastic telephone handset with 6 feet long permanently coiled cord.
- D. Controls and Indicators: Mark each control and indicator with legible and permanent nameplates. Provide the following minimum controls and indicators:
 - 1. Ten digit, silent operating touch keypad.
 - 2. Digital display units.
 - 3. RESET switch.
 - 4. Audible tone signal for incoming calls.
 - 5. Nurse register.
 - 6. SYSTEM BUSY indicator lamp.
 - 7. STATUS SCAN switch to indicate medical status of each call station.
 - 8. REMINDER switch to set reminder status for each call station.
 - 9. Speaker disconnect by lifting handset.
 - 10. INTERCOM/MONITOR speaker switch.

2.02 SYSTEM CONTROL UNIT

- A. Description: Surface wall mounted intercom control unit.
- B. Intercom Amplifier: 15 watts rated output with less than 5 percent total harmonic distortion, frequency response of 100 to 10,000 Hz. plus or minus 3 dB, and minimum 60 dB signal-to-noise ratio at rated output.
- C. Input and Output Lines: Use balanced transformers.
- D. Provide terminal blocks for external wiring connections.

- E. Controls and Indicators: Provide the following, minimum:
 - 1. Handset transmitter volume control.
 - 2. Handset receiver volume control.
 - 3. Master listen volume control.
 - 4. Master talk volume control.
 - 5. Input limiter control.
 - 6. Tone control.

2.03 SYSTEM POWER SUPPLY

- A. Description: Mounted in system control unit cabinet.
- B. Input Rating: 120 240 volts, 60 Hz., single phase. Provide input fuse.
- C. Output Ratings: Provide output power at voltage, regulation, and noise level to meet requirements of nurse system switching and control unit. Limit output during overload or short circuit conditions to less than 100 volt-amperes, with automatic restoration to normal operation after overload or short circuit conditions are cleared.
- D. Standby Operation: Provide integral batteries and battery charger to provide uninterrupted operation of nurse call system for a minimum of 10 minutes during an input power outage.
- E. Provide output contacts for remote power supply monitor and alarm.
- F. Provide terminal blocks for external wiring connections.

2.04 CALL STATIONS

- A. Patient Call Station: Recessed wall mounted call station.
 - 1. Integral speaker/microphone.
 - 2. Call cord receptacle.
 - 3. CANCEL switch.
 - 4. CALL ASSURANCE light indicating station call. Provide two lights for two-bed patient station.
 - 5. PRIVACY switch to disable microphone function of speaker.
 - 6. System Monitor: Key-operated switch to enable patient station to function as system monitor.

7. Staff Assist Switch: Integral pushbutton switches with engraved legend PUSH FOR HELP.
 8. Stainless steel faceplate.
- B. Emergency Station: Recessed wall mounted call station, suitable for use in wet locations, and with the following features:
1. Pull Cord Actuated Station: Enclosed switch with six-foot nylon cord, held by breakaway chain.
 2. Push Actuated Station: Red pushbutton pads with engraved legend PUSH FOR HELP.
 3. CANCEL switch.
 4. CALL ASSURANCE light to indicate station call.
 5. Stainless steel faceplate.
- C. CODE BLUE station: Recessed wall mounted call station, with the following features:
1. Red pushbutton pad with engraved legend CODE BLUE.
 2. CANCEL switch.
 3. CALL ASSURANCE light to indicate station call.
 4. Stainless steel faceplate.
- D. Duty Station: Recessed wall mounted call station with the following features:
1. Integral speaker/microphone.
 2. INCOMING CALL indicator light.
 3. INCOMING CALL tone.
 4. CALL switch.
 5. CANCEL switch.
 6. Stainless steel faceplate.
- E. Staff Station: Recessed wall mounted call station, with the following features:
1. Integral speaker/microphone.
 2. CALL switch.
 3. CANCEL switch.

4. CALL ASSURANCE light indicating station call.
5. Stainless steel faceplate.

2.05 ACCESSORIES

- A. Corridor Light: Wall or ceiling mounted indicating light units, with the following features:
 1. Single lamp units: Red lens.
 2. Two lamp units: Red and green lens.
 3. Three lamp units: Red, green, and blue lens.
 4. Four lamp units: Red, green, blue, and white lens.
 5. Enclosure: Heat resistant diffuser with barriers to separate lamps.
 6. Reminder status control.
- B. Call Cord: Pushbutton switch in plastic housing, molded to six-foot cord with plug to fit patient station receptacle. Provide non-removable stainless steel sheet clamp.
- C. Switch Plug: Enclosed switch with integral plug to fit patient call station.
- D. Dummy Plug: Plug-in unit to prevent continuous call in inactive patient station.

2.06 NURSE CALL SYSTEM CABLE

- A. Home Run Cable: Twisted, shielded pair, 20 AWG.
- B. Master Station Interconnect Cable: Eleven twisted, shielded pairs, 22 AWG.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install patient call stations at 48 inches above finished floor.
- C. Install lavatory emergency stations at 48 inches above finished floor.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Perform operational tests on each item of equipment and on system.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Provide manufacturer's field services under provisions of Division 1.
- B. Observe installation of nurse call equipment.
- C. Provide field technician services to make final signal cable connections to equipment.
- D. Prepare and start systems.
- E. Provide systems demonstration.

3.04 ADJUSTING

- A. Adjust work under provisions of Division 1.
- B. Adjust controls to achieve proper operation.
- C. Set medical status of each patient and staff station as directed.

3.05 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 1.
- B. Allow minimum 24 hours for demonstration of system.
- C. Demonstrate system operation to designated Owner personnel.
- D. Conduct walking tour of Project and briefly describe function, operation, and maintenance of each component.
- E. Use submitted operation and maintenance manual as reference during demonstration and training.

END OF SECTION

SECTION 16760
INTERCOM SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Intercom equipment.
- B. Intercom cable.
- C. Accessories.

1.02 RELATED SECTIONS

- A. Section 16123 – Building Wire and Cable.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate cable routing and connections.
- C. Submit product data for each item of equipment.
- D. Submit manufacturer's installation instructions.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 01700.
- B. Accurately record actual locations of devices and wiring.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Operation Data: Include instructions for routine operation of master and remote stations.
- C. Maintenance Data: Include instructions for minor troubleshooting, preventive maintenance, and cleaning.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.

- B. Supplier: Company authorized by manufacturer and specializing in supplying products specified in this Section with minimum five years documented experience.
- C. Installer: Company specializing in installing the products specified in this Section with minimum five years documented experience.

1.07 MAINTENANCE SERVICE

- A. Furnish service and maintenance of intercom system for one year from Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 INTERCOM SYSTEM

- A. Description: Private voice communication between locations indicated on Drawings.
- B. Sequence of Operation: Master selects any or all-remote stations by entering one-two three digit number associated with that station or all call. Only the selected station can communicate.
- C. Interconnection with Public Telephone System: Dial one digit number associated with outgoing line for interconnection with local calls only allowed.

2.02 DIRECT CONNECTED, KEYED MASTER INTERCOM STATION

- A. Description: Desk-mounted master intercom unit.
- B. Intercom Amplifier: 2 watts rated output with less than 5 percent total harmonic distortion, frequency response of 100 to 10,000 Hz plus or minus 3 dB, and minimum 60 dB signal-to-noise ratio at rated output.
- C. All-Call Amplifier: 1 watt rated output for each connected station, with less than 5 percent total harmonic distortion, frequency response of 100 to 10,000 Hz plus or minus 3 dB, and minimum 60 dB signal-to-noise ratio at rated output.
- D. Speaker Sensitivity: 92 dB.
- E. Input Sensitivity: Provide adequate input sensitivity to deliver rated amplifier output when no more than 10 dynes per square centimeter impinge on speaker/microphone.
- F. Handset: Standard molded plastic telephone handset with 6-ft long permanently coiled cord.
- G. Minimum Controls and Indicators:
 - 1. POWER ON-OFF selector switch and indicator lamp.

2. Selector switch for each master, remote station, all call, and each zone call.
3. Lighted annunciator lamp for each master and speaker/microphone station.
4. Audible signal for incoming calls.
5. CALLED STATION BUSY indicator lamp.
6. Speaker disconnect by lifting handset.
7. VOLUME control for listen volume level only.
8. PRIVACY switch.
9. TALK/LISTEN switch.
10. Mark each control and indicator with legible and permanent nameplates.

H. Sequence of Operation:

1. Remote selector switches connect master directly to remote stations.
2. Manual momentary switch sets TALK/LISTEN mode.
3. Incoming calls actuate annunciator lamp and momentary buzzer.
4. Privacy switch turns off microphone.

2.03 CENTRAL CONTROL MASTER INTERCOM STATION

- A. Description: Desk-mounted master intercom unit.
- B. Speaker Sensitivity: 92 dB.
- C. Handset: Standard molded plastic telephone handset with 6 long permanently coiled cord.
- D. Minimum Controls and Indicators:
 1. POWER ON-OFF selector switch and indicator lamp.
 2. Ten digit, silent operating touch keypad.
 3. Lighted annunciator lamp for each master and] speaker/microphone station.
 4. Audible signal for incoming calls.

5. CALLED STATION BUSY indicator lamp.
6. SYSTEM BUSY indicator lamp.
7. Speaker disconnect by lifting handset.
8. VOLUME control for listen volume level only.
9. PRIVACY switch.
10. Mark each control and indicator with legible and permanent nameplates.

2.04 INTERCOM CONTROL UNIT

- A. Description: Recessed wall-mounted intercom control unit.
- B. Intercom Amplifier: 2 watts rated output with less than 5 percent total harmonic distortion, frequency response of 100 to 10,000 Hz plus or minus 3 dB, and minimum 60 db signal-to-noise ratio at rated output.
- C. All-Call Amplifier: 1 watts rated output for each connected station, with less than 5 percent total harmonic distortion, frequency response of 100 to 10,000 Hz plus or minus 3 dB, and minimum 60 dB signal-to-noise ratio at rated output.
- D. Input Sensitivity: Provide adequate input sensitivity to deliver rated amplifier output when no more than 10 dynes per square centimeter impinge on speaker/microphone.
- E. Sequence of Operation:
 1. Intercom Control Unit connects calling station to remote stations.
 2. Manual momentary switch with sustained TALK sets TALK/LISTEN mode.
 3. Incoming calls actuate annunciator lamp and momentary buzzer at called station.
 4. Privacy switch turns off microphone.

2.05 SPEAKER/MICROPHONE INTERCOM UNITS

- A. Description: Desk-mounted unit.
- B. Sensitivity: 92 dB at one W input, four ft on axis of speaker.
- C. Handset: Standard molded plastic telephone handset with 6 permanently coiled cord.
- D. Controls and Indicators:

1. POWER ON-OFF selector switch and indicator lamp.
2. Call in switch for one master station.
3. Lighted annunciator lamp for incoming call.
4. Recurring audible signal for incoming call.
5. CALLED STATION BUSY indicator lamp.
6. Speaker disconnect by lifting handset.
7. VOLUME control for listen volume level only.
8. PRIVACY switch.
9. TALK/LISTEN switch.
10. Mark each control and indicator with legible and permanent nameplates.

E. Sequence of Operation:

1. Master selector switches connect unit directly to master stations.
2. Manual momentary switch with sustained TALK position sets TALK/LISTEN mode.
3. Incoming calls actuate annunciator lamp and momentary buzzer.
4. Privacy switch turns off microphone.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as shown on Drawings. and instructed by manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.03 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01400.
- B. Perform operational test on completed installation to verify proper operation.
- C. Replace equipment, components, and wiring to eliminate audible noise, clicks, pops, or hum when system is in standby or operation.

3.04 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Section 01600.
- B. Make final connections to units.
- C. Perform field inspection and testing.
- D. Demonstrate system operation.

3.05 ADJUSTING

- A. Adjust work under provisions of Section 01650
- B. Adjust controls and configuration switches for operation as indicated.

3.06 DEMONSTRATION

- A. Provide systems demonstration and instructions under provisions of Section 01650. Allow minimum of 24 hours.
- B. Employ manufacturer's field representative to demonstrate system operation to designated Owner personnel.
- C. Conduct walking tours of Project and briefly describe function, operation, and maintenance of each component.
- D. Use submitted operation and maintenance manual as reference during demonstration and training.

END OF SECTION

SECTION 16781

TELEVISION DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Television service entrance.
- B. Television distribution equipment.
- C. Cable and accessories.

1.02 RELATED SECTIONS

- A. Section 16111 - Conduit.
- B. Section 16130 - Boxes.
- C. Section 16170 - Grounding and Bonding.

1.03 REFERENCES

- A. NFPA 70 - National Electrical Code.

1.04 SYSTEM DESCRIPTION

- A. Service entrances from local cable utility.
- B. Premises wiring for broadband distribution of television signal, including individual outlets.

1.05 PERFORMANCE REQUIREMENTS

- A. Signal at each outlet: 3 dBmV across 75 ohms, minimum, + 5 dB, - 0 dB.

1.06 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements. Show installation details, cable routing, and system configuration.
- C. Product Data: Provide showing electrical characteristics and connection requirements for each component.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for

storage, handling, protection, examination, preparation, installation, and starting of Product.

1.07 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01700.
- B. Record actual locations of outlets, devices, and cable routing.

1.08 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Operation Data: Instructions for setting and tuning channels.
- C. Maintenance Data: Basic trouble-shooting procedures.

1.09 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Supplier: Authorized distributor of specified manufacturer with minimum five years documented experience.
- C. Installer: Authorized installer of specified manufacturer.

1.10 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.
- C. Conform to requirements of cable television utility company.

1.11 MAINTENANCE SERVICE

- A. Furnish service and maintenance of television system for one year from Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 VHF PREAMPLIFIER

- A. Provide broadband preamplifier for channels required.
- B. Impedance: 75 ohm.
- C. Bandpass: 6 MHz, plus or minus 0.25 dB.

- D. Gain: 24 dB, minimum.
- E. Signal-to-Noise Ratio: 3 db maximum.
- F. Power Supply: Remote, impedance matched for 22-dB return loss, 0.2 dB through loss. Provide 120 volt, single phase input.

2.02 TV CABLE RECEIVER

- A. Provided by cable utility.
- B. Tap:
 - 1. Recessed, suitable for mounting with standard duplex receptacle wall plate, all channel, back-matched tap.
 - 2. Through Loss: 0.7 dB, maximum.
 - 3. Return Loss: 20 dB, maximum.
 - 4. Connector: Pin type coaxial connector.
- C. Splitter:
 - 1. Inline, all channel, back-matched splitter.
 - 2. Through Loss: 3.5 dB for two-way; 6.7 dB for four-way.
- D. Branch Distribution Cable:
 - 1. Description: RG 59/F.
- E. Television Lead Cable:
 - 1. Provide set-matched cord. Use RG 59/F coax cable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Connect cable television service in accordance with cable Utility instructions.
- C. Provide proper grounding of television system components and wiring.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01400.

- B. Measure signal level at each outlet.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Section 01400.
- B. Supervise final adjustments and tuning of system.

3.04 ADJUSTING

- A. Adjust work under provisions of Section 01650.
- B. Adjust work under supervision of manufacturer's field service personnel.

3.05 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 01670.
- B. Demonstrate system operation and provide one hour of instruction with manufacturer's training personnel.
- C. Conduct walking tour of Project and briefly describe function, operation, and maintenance of each component.

END OF SECTION