



TETER, LLP

ARCHITECTS ENGINEERS CONNECTED

PROJECT MANUAL

CONTRACTUAL – LEGAL REQUIREMENTS
TECHNICAL SPECIFICATIONS

FOR

**FRESNO UNIFIED SCHOOL DISTRICT
SECURITY CAMERA SYSTEMS UPGRADE AT
TWO CAMPUSES**

Project No.: 19-11524

District Bid No.: 21-32

Set No.: _____

SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Owner furnished, contractor installed products.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.

1.3 PROJECT INFORMATION

- A. Project Identification:

Camera System for Hamilton E.S. and Wawona E.S.
Fresno, California

- B. Owner:

Fresno Unified School District
4600 N. Brawley Ave.
Fresno, CA 93722

Telephone: (559)457-3070
Contact: Brian Miller

- C. Electrical Engineer:

TETER, LLP
7535 North Palm Avenue, Suite 201
Fresno, California 93711

Telephone 559.437.0887
Contact: Bryan Glass
Engineer's Project Number: 19-11524

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and consists of the following:
 - 1. Contractor to install new video surveillance equipment at each campus. Work to include selective demolition and repairs, trenching, electrical, conduit and surface raceway installation, and low voltage cabling.
- B. Type of Contract: Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by the Owner.
- B. Subsequent Work: The owner will perform the following additional work at the site after Substantial Completion. Completion of that work will depend on the successful completion of preparatory work under this Contract.
 - 1. Configuration of equipment on FUSD network and final DVR programming.

1.6 OWNER-FURNISHED CONTRACTOR-INSTALLED PRODUCTS

- A. Owner will furnish products indicated. Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.
- B. Owner-Furnished Products:
 - 1. Digital Video Recorders (DVR)
 - 2. Video Surveillance Cameras (CCTV) and Mounting Brackets
 - 3. LCD Monitors and Mounting Brackets
 - 4. Camera Power Supplies

1.7 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Driveways, Walkways, and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees,

and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

- a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing buildings affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 2. Notify the Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.9 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on the use of public streets and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing buildings to periods when students and staff are not present.
1. Normal school hours are 7:00 a.m. to 4:00 p.m., Monday through Friday.
 2. Submit a written request to the Engineer and Owner for work hours outside of the indicated on-site hours; request subject to approval by the Owner.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Engineer and Owner not less than 2 days in advance of proposed disruptive operations.
- D. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 26 00 00
SUMMARY OF ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

- A. In general, the Electrical Work described herein consists of the modification of existing electrical and signal systems in place and the installation of new electrical and signal systems equipment. All work shall be completed as directed by the Owner's authorized representative, in accordance with the Contract, Specifications and Construction Documents listed below.

1. General Conditions of Contract
2. Specifications:

Section	Title
26 00 00	Summary of Electrical Work
26 01 00	General Conditions for Electrical Work
26 05 00	Basic Electrical Materials and Methods
27 20 00	Communications Systems
28 20 00	Video Surveillance

3. Electrical Construction Drawings as listed on the Drawing Index of the Construction Drawing set.
- B. This Section includes all necessary and required work to complete the construction as indicated in the Drawings, called for by notes or schedules, or specified herein. This work includes the furnishing of all permits, labor, supervision, services, materials, tools, equipment, testing, transportation and miscellaneous expenses, and the performance of all operations necessary to or incidental to completion of lawful and operating electrical power, and signal systems, whether or not specifically mentioned.
- C. All work not shown in complete detail shall be installed per the CEC and in conformance with the best standard practice for the trade. Any deviation from the approved Drawings shall be submitted in writing to the Engineer and Owner for approval prior to the installation of the work in question.
- D. This work shall include, but not necessarily be limited to, the following elements:
1. Demolition and Phasing:
 - a. De-energize, disconnect and remove electrical feeds to devices and equipment being removed or relocated.
 2. Signal Distribution:

- a. Trenching, conduits and conductors for signal systems including connections to relocatable buildings.
 - b. Building mounted conduits and conductors for signal systems including connections to relocatable buildings.
- 3. Building Electrical:
 - a. Remove, extend and re-install electrical devices in/on walls receiving new wall coverings.
 - b. Provide new branch circuits to replace those demolished. Circuits are to be hidden in walls where wall surfaces are being replaced.
 - c. Provide surface wireways for replacement of circuits and feeders where wall surfaces are to remain.
- 4. Data Distribution System
 - a. Extension of existing Data system.
- 5. Video Surveillance System:
 - a. Replace existing Video surveillance cameras and cabinets with new equipment per Specification 28 20 00.
- 6. Each system shall be terminated, tested and calibrated by a factory-authorized installer. This same installer shall terminate and test any peripheral equipment required for the operation of the system.
- 7. Equipment Connections
 - a. Provide equipment connections and coordination in accordance with manufacturer's recommendations and product submittals.
- E. Products supplied by Owner (or others, as noted) and installed by Contractor under this Section.
 - 1. Video surveillance cameras, DVRs, power supplies, LCD monitors, and converters.
- F. Products supplied by the Contractor but not installed under this Section.
 - 1. None.
- G. Work specifically **excluded** from this Division.
 - 1. None
- H. The following sections contain requirements that relate to this Section:
 - 1. None
- I. It shall be understood that the existing conduit with its wiring is presently active (hot), in operation with its pertinent equipment.
- J. It shall be noted that this construction work will be planned and executed during the ongoing operation of the facility. Any modifications to the existing equipment currently in operation shall be done during scheduled shutdowns and coordinated with the Owner's authorized representative and facility operating personnel to assure minimum downtime.

- K. To avoid disruption to facility operations, certain items of work must be completed before other items of work can be started. The contractor shall coordinate with the Owner's authorized representative as to the sequence of construction activities.
- L. Drawings showing equipment layout, conduit runs, conduit sizes, number of wires, wire types, wire groupings, and size will not be furnished. It shall be the Contractor's responsibility to prepare such drawings per specifications, project requirements, and code to facilitate the installation.
- M. Size, furnish, install and connect new conduit, conduit fittings, and seal fittings, expansion fittings, and supports. This includes above grade as well as underground.
- N. Size, furnish, and install junction, pull, and terminal boxes, per code requirements and as shown on the construction drawings.
- O. Size, furnish and install all supports required for conduit installation, supports required for the installation of the equipment furnished by this Contractor and equipment furnished by others but installed by this Contractor.
- P. Size and field cut the openings for conduits passing through building walls and/or floors. Close and seal all openings after conduits have been installed and/or removed. Closing shall be compatible with, or of the same material as wall and/or floor.
- Q. Furnish and install wire tags per the specifications indicating wire number as shown on electrical schematics, one line, three-line diagrams and specifications.
- R. Perform all testing per the Specifications and report to the Owner's field representative in a timely manner so as not to impede the scheduled completion of the Contract.
- S. Prime and paint all uncoated carbon steel items furnished by the Contractor.
- T. Energize low voltage services after testing equipment and wiring per manufacturer instructions and specifications.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION 26 00 00.1

SECTION 26 01 00
GENERAL CONDITIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

- A. The provisions of this Section shall apply to all of the following Sections of Divisions 26-28 of these Specifications and shall be considered a part of these Sections.

1.3 QUALITY ASSURANCE

- A. All work and materials shall fully comply with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications shall be interpreted as to permit any work not in compliance with these codes. Where work is detailed and/or specified to a more restrictive standard or higher requirement, that standard or requirement shall govern such work. Applicable codes include, but are not limited to, the following:
 - 1. California Code of Regulations (CCR)
 - a. Title 8, Industrial Relations
 - b. Title 17, Public Health
 - c. Title 24, Building Standards
 - 2. 2019 California Building Code.
 - 3. 2019 California Fire Code.
 - 4. 2019 California Electrical Code.
 - 5. Local Codes.
- B. All electrical components, devices and accessories shall be listed with Underwriters Laboratories, Inc. (or other testing agency acceptable to authorities having jurisdiction), shall meet their requirements, shall bear their label wherever standards have been established and label service is regularly furnished by that agency, and shall be marked for intended use.

1.4 PERMITS, FEES AND TAXES

- A. The Contractor shall secure all necessary permits and pay all required fees and taxes. He shall notify the proper authorities and have the work inspected and tested as required by jurisdictional requirements, pay all charges in connection therewith, and shall present to the Owner properly signed certificates of inspection. Acceptance of the work will not be considered until such certificates have been delivered.

1.5 EXISTING CONDITIONS

- A. The Contractor shall carefully examine the site and existing buildings, compare them with Drawings and Specifications, and shall have satisfied himself as to the conditions to be encountered during the performance of the work. No subsequent allowance shall be made on his behalf for any additional expense he may incur due to failure or neglect of Contractor to examine site and to include existing conditions in bid.
- B. Any work done as an addition, expansion, or remodel of an existing system shall be compatible with that system.
- C. The Contractor shall examine all record drawings made available by the Owner to locate existing underground systems, utilities, conduits, and pipes prior to installing the electrical distribution system. The Contractor shall also examine the site for possible locations of sprinkler pipes. Any damage done to the existing systems during the course of the electrical work, whose locations could be reasonably determined, shall be repaired to the satisfaction of the Owner and the utility or agency involved, at the expense of the Contractor.

1.6 CONDUCT OF THE WORK

- A. The Contractor shall maintain on the job a competent foreman or a superintendent at all times to superintend the Work.

1.7 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

- A. The Engineer's decision will be final on interpretation of the Drawings and Specifications. Whenever the words "AS MAY BE DIRECTED", "SUITABLE", or "APPROVED EQUAL", or other words of similar intent and meaning are used, implying that judgment is to be exercised, it is understood that it is in reference to the judgement of the Engineer.

1.8 SUBMITTALS

- A. Shop Drawings and Product Data
 - 1. All **Shop Drawings and Product Data** shall comply with the following requirements:
 - a. The Contractor shall submit for review, complete sets of Shop Drawings and Product Data brochures for materials and equipment as required by each section of the Specifications.
 - b. All Shop Drawings and Product Data shall be submitted at one time in a neat and orderly fashion in a suitable binder with a Title Sheet including Project, Engineer and Contractor, Table of Contents, and indexed tabs dividing each group of materials or item of equipment. The Specification paragraph number for which they are proposed shall identify all items. The mark number as indicated on Drawings shall also identify all equipment and fixtures.
 - c. Shop Drawings and Product Data submittal shall include manufacturer's name and catalog numbers, dimensions, loads, and all other characteristics and accessories as listed in the Specifications or on the Drawings. All loads, characteristics, and accessories called for in the Specifications or on the Drawings shall be highlighted, circled or

underlined on the Shop Drawings and Product Data. Descriptive literature shall be current factory brochures and submittal sheets.

- d. FAX submittals are not acceptable.
- e. Material or equipment shall not be ordered or installed until the Engineer processes the written review. Any item omitted from the submittal shall be provided as specified without substitution.
- f. Prior to submission of the Shop Drawings and Project Data, Contractor shall review and certify that they meet the requirements of the Contract Documents.
- g. A minimum period of two weeks, exclusive of transmittal time, will be required each time Shop Drawings and/or Product Data are submitted or resubmitted for review. The Contractor shall consider this time when scheduling a submittal date.

B. Submittal Review

1. Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the Drawings and Specifications.
2. The Contractor shall agree that Shop Drawings and Product Data submittals processed by the Engineer are not Change Orders and that the purpose of Shop Drawings and Product Data submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept. The Contractor demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.
3. It shall be clearly understood that the noting of some errors, but the overlooking of others, **does not** grant the Contractor permission to proceed in error or in conflict with Contract Documents. The Contractor shall agree that if deviations, discrepancies or conflicts between Shop Drawings and Design Drawings and Specifications are discovered either prior to or after Shop Drawing submittals are processed by the Engineer, the Design Drawings and Specifications shall control and shall be followed.
4. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

C. Substitutions

1. **Substitutions** shall comply with the following requirements:
 - a. Manufacturers, model numbers and other pertinent information listed in the Specifications or on the Drawings are intended to establish minimum standards of performance, function and quality. Unless otherwise noted, the Contractor may submit equivalent compatible UL-listed equipment from other manufacturers for review, as long as the minimum standards are met.
 - b. Calculations and other detailed data indicating how the item was selected shall be included for items that are not specified. Data must be complete enough to permit detailed comparison of every significant feature, function, performance, and quality characteristic that is specified, scheduled or

detailed. The comparison must prove that the substituted item equals or exceeds the requirements of the specified item.

- c. The Contractor shall assume full responsibility that substituted items or procedures will meet the Specification and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.
- d. At the Engineer's request, the Contractor shall furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.

D. Record Drawings

1. **Record Drawings** shall comply with the following requirements:

- a. At the beginning of the Project, one print of each applicable Drawing will be issued to the Contractor specifically for use in preparing Record Drawings. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the Drawings. Final locations of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, e.g. building, curbs, walks. The original Drawings will be made available to the Contractor, from which he shall have made, a set of reproducible Drawings. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible Drawings. The Record Drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review, after first securing the Inspector's verification by signature.

E. Operations and Maintenance Instructions

1. **Operations and Maintenance Instructions** shall comply with the following requirements:

- a. Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. UPS-1). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation.
- b. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. MCC, UPS, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included.
- c. The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The Engineer's office shall be notified 48 hours prior to this meeting.
- d. The Contractor shall prepare a letter indicating that all Operation and Maintenance Instructions (printed and verbal) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 COORDINATION

- A. Electrical Drawings are essentially diagrammatic, unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, conduits, fixtures, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interferences with each other, or with architectural, civil, mechanical, plumbing, structural or other elements.
- B. While the size and location of equipment are shown to scale wherever possible, all dimensions and conduit/conductor data shall be verified in the field.
- C. Where the work requires connections to be made to equipment furnished and set in place by others, the Contractor shall obtain exact rough-in dimensions from the manufacturer of such equipment and he shall install the connections in a neat and workmanlike manner.
- D. If discrepancies are discovered between Drawings and Specifications requirements, the more stringent requirement shall apply.
- E. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.
- F. No work shall be prefabricated or installed prior to this coordination. No additional compensation will be considered to the Contractor for any prefabrication or installation performed prior to this coordination.

1.10 SCHEDULING

- A. All work shall be scheduled subject to the review of the Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work for which contracted, as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner.

1.11 WARRANTY

- A. Guarantee shall be in accordance with the General Conditions. These Specifications may extend the period of the guarantee for certain items. Where such extension are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.
- B. Contractor shall deliver to the Owner a written guarantee on all workmanship, materials and equipment for a period of one (1) year from the date of acceptance by the Owner. Any work found to be faulty during that period of time shall be corrected at once, upon written notification, at the expense of the Contractor. This shall include repair or replacement of the premises that may be damaged as a result of faulty work and materials furnished.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be new unless otherwise noted.
- B. Materials and equipment of a given type shall be by the same manufacturer.
- C. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance. Upon completion of work and prior to final inspection, Contractor shall thoroughly clean all exposed fixtures, trim and equipment, and shall leave the entire installation in neat, clean, and useable condition. Materials and equipment shall be free of dents, scratches, marks, shipping tags, and all defacing features at time of project acceptance.
- D. The Contractor shall order materials and equipment in a timely manner to prevent any delay in the construction schedule, and he shall bear any penalty by vendors to meet schedules.
- E. Verify all dimensional information to ensure proper clearance for installation of equipment. Check all materials and equipment after arrival on the jobsite and verify compliance with the Contract Documents.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. The Contractor shall protect existing electrical equipment and installations that are not indicated to be removed. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Exposed electrical equipment and installations, indicated to be demolished, shall be removed in their entirety.
- C. Buried raceway and wiring, indicated to be abandoned in place, shall be cut 2 inches below the surface of adjacent construction and removed in its entirety. Raceways abandoned in place shall be capped and disturbed surfaces shall be patched to match existing finish.
- D. Demolished material shall be removed from Project site.
- E. Components indicated for relocation shall be removed, stored, cleaned, reinstalled, reconnected, and made operational.
- F. All existing equipment removed and replaced shall be delivered to the District Maintenance Department.

3.2 CUTTING AND PATCHING

- A. The Contractor shall perform all cutting and drilling, or other work, required to provide openings in walls, ceilings, floors, footings, foundations or other structures necessary to accomplish work under this Specification Division. The cutting shall be performed by skilled mechanics of the trades involved.
- B. Cutting or coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

- C. Wherever possible, work shall be done in a concealed and neat workmanlike manner requiring the least amount of cutting of studs, plates and woodwork. Such cutting or notching is allowed only after consultation with and by permission of the Engineer.
- D. The Contractor shall repair and refinish disturbed finish materials and other surfaces to accurately match adjacent undisturbed new or existing structures and surfaces and shall install new fireproofing where existing fire-stopping has been disturbed. The repair and refinishing of materials and other surfaces shall be by skilled mechanics of the trades involved.
- E. All cuts are to be clean with no chipping. Where chipping occurs as a result of work in a cut area, a new clean cut shall be made immediately prior to patching.

3.3 SEISMIC ANCHORAGE AND BRACING

A. Equipment Anchorage

1. All electrical equipment and components shall be anchored and installed per the details on the approved construction documents. Where no detail is indicated, the following components shall be anchored or braced to meet the force and displacements requirements prescribed in the 2019 CBC, Sections 1617A.1.18 through 1617A.1.26. and ASCE 7-16 Chapter 13, 26, and 30:
 - a. All permanent equipment and components
 - b. Temporary or movable equipment that is permanently attached (e.g. hard wired) to building utility electrical service.
 - c. Movable equipment which is stationed in one place for more than 8 hours and heavier than 400 pounds are required to be anchored with temporary attachments.
2. The attachment of the following electrical components shall be positively attached to the structure, but need not be detailed on the plans. These components shall have flexible connections provided between the components and associated conduit.
 - a. Components weighting less than 400 pounds and have a center of mass located 4 feet or less above the adjacent floor or roof level that directly support the components.
 - b. Components weighting less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.

For those elements that do not require details on the approved drawings, the installation shall be subject to the approval of the Structural Engineer of Record. The project inspector will verify that all components and equipment have been anchored in accordance with above requirements.

B. Electrical Distribution System Bracing

1. Electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7-16 Section 13.3 as defined in ASCE 7-16 Section 13.6.7, 13.6.6, 13.6.5, and 2019 CBC, Sections 1617A.1.23, 1617A.1.24, 1617A.1.25, and 1617A.1.26.

2. Copies of the manual shall be available on the jobsite prior to the start of hanging and bracing of the electrical distribution systems.
3. The Structural Engineer of Record shall verify the adequacy of the structure to support the hanger and brace loads.

3.4 CLEANING AND PROTECTION

- A. The Contractor shall, progressively and at completion of the job, thoroughly clean all of his work including outlets, fittings, and devices, and inspect exposed finishes. The Contractor shall remove all burrs, dirt, grease, paint spots, stains, labels, tags, rust, foreign material, and construction debris resulting from his work.
- B. The Contractor shall protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 01 00

SECTION 26 05 00
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

- A. See Section 26 00 00

1.3 STANDARDS

- A. NEMA 250 Standard for Enclosures for Electrical Equipment
(1000 Volts Maximum)

PART 2 - PRODUCTS

2.1 CONCRETE PADS, PULL BOXES AND MANHOLES

- A. At the Contractor's option, he shall provide cast-in-place or pre-cast structures.
- B. Concrete Forms and Reinforcement Materials shall be as specified in Division 03 Section "Cast-in-Place Concrete".
- C. Concrete shall be 2500-psi, 28-day compressive strength as specified in Division 03 Section "Cast-in-Place concrete".
- D. Weatherproof concrete pull boxes, junction boxes and telephone boxes shall be manufactured by Christy Concrete Products or equal. All boxes shall have lids marked "Power", "Signal", "Fiber Optic", "Danger-High Voltage", etc. and be traffic-rated per CalTrans drawing ES-8 minimum where pull box occurs in vehicular traffic areas.

2.2 RACEWAYS AND FITTINGS

- A. Galvanized rigid steel conduit (GRC) shall meet ANSI C80.1, and be heavy wall, hot dipped galvanized inside and out, with threaded ends, for use with threaded type fittings.
- B. Galvanized intermediate metallic conduit (IMC) shall meet ANSI C80.6, be zinc-coated steel and have threaded fittings.
- C. Galvanized electrical metallic tubing (EMT) shall meet ANSI C80.3, and be continuous, seamless steel tubing, galvanized or sherardized on exterior, coated on interior with

smooth hard finish of lacquer, varnish or enamel, with steel set-screw, steel compression or die-cast compression type fittings. Provide concrete-tight type compression fittings where required and rain-tight wet location listed compression fittings for outdoor locations.

- D. Rigid non-metallic conduit (RNC) shall meet NEMA TC 2, be Schedule 40 PVC, suitable for 90°C, with solvent cemented type NEMA TC3 fittings.
- E. Flexible metallic conduit (FMC) shall be single strip, continuous, flexible interlocked double-wrapped steel, hot dip galvanized inside and out forming smooth internal wiring channel, with steel, compression type fittings.
- F. Liquid-tight flexible metallic conduit (LFMC) shall be same as FMC except with inert sunlight-resistant, mineral-oil-resistant watertight plastic outer jacket. Fittings shall be cast malleable iron body and gland nut, cadmium plated with one-piece brass grounding bushings threaded to interior of conduit. Spiral molded vinyl-sealing ring between gland nut and bushing and nylon-insulated throat.
- G. All raceway fittings shall be specifically designed for the raceway type with which used.

2.3 SURFACE MOUNTED RACEWAY

- A. Surface Mounted Raceways and system components shall be composed of U.L. Listed materials and exhibit nonflammable self-extinguishing characteristics.
- B. Surface Mounted Raceway shall be a two-piece design with a base and snap-on cover(s). The raceway base shall accept either a single cover that spans the entire base or two individual covers which together cover the base and allow independent access to services.
- C. Surface Mounted Raceway shall be available with two or three wiring channels separated by integral barriers. One channel must be large enough to accept standard power and communication devices without restricting capacity of the adjacent channel. The raceway base and cover shall be available in ivory or white.
- D. Device brackets shall be available for mounting standard devices in-line or offset from the raceway. A device bracket shall provide up to three single-gang openings at one location. Faceplates shall match raceway and fit flush in the device plate.
- E. The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP, STP (150 ohm), fiber optic, coaxial and other cabling types with faceplates and bezels to facilitate mounting. A complete line of preprinted station and port identification labels, snap-in icon buttons, as well as write-on station identification labels shall be available.
- F. A complete line of full capacity corner elbows and tee fittings must be available to maintain a controlled 2" cable bend radius which meets the specifications for Fiber Optic and UTP/STP cabling and exceeds the TIA / EIA 569-A requirements for communications pathways.
- G. A full complement of fittings must be available including, but not limited to tees, entrance fittings, cover clips, and end caps. The fittings shall have a matte texture, in ivory or white colors to match the base and cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering. Transition fittings shall be available to adapt to other raceways.

- H. Surface Mounted Raceway shall be single-channel by the Wiremold Company, or equal:
 - 1. 4000 Series
 - 2. 3000 Series
 - 3. 2400 Series
 - 4. 500 Series

2.4 CONDUCTORS

- A. All conductors shall be delivered to the site in their original unbroken packages, plainly marked or tagged with UL labels, size, type of wire, type of insulation, name of the manufacturing company and trade name of the wire.
- B. All conductors shall be minimum of 98% conductivity soft drawn copper. Conductors #8 AWG and larger shall be stranded type "THWN/THHN", 600 Volt insulation. Conductors #10 AWG and smaller shall be solid copper "THWN/THHN", 600 Volt insulation.
- C. Insulation shall be Thermoplastic Type rated at 75 degrees C. minimum.

2.5 PULL BOXES AND WIREWAYS

- A. Pullboxes and Enclosures for outdoor use shall be NEMA 250, Type 3R or Type 4, unless otherwise noted.
- B. Pullboxes and Enclosures for indoor use shall be NEMA 250, Type 1, unless otherwise noted.
- C. Wireways shall be constructed in accordance with UL 870 for wireways, auxiliary gutters and associated fittings. Every component including lengths, connectors and fittings shall be UL Listed.
- D. Wireways and auxiliary gutters shall have continuous removable cover secured with screws and keyhole slots. Hinged cover shall be provided where installed above suspended ceiling.
- E. Fabricated sheet steel pull boxes shall be installed only in dry, protected locations and shall be furnished with knockouts and removable screw cover. Box shall be finished with one coat of zinc chromate and a coat of primer sealer and where exposed to public view shall be painted to match the surrounding surface.
- F. Weatherproof sheet steel pull boxes shall be fabricated of code gauge galvanized sheet steel with two coats of rust resistant finish and shall be furnished with gasket and made completely weathertight.

2.6 WIRING DEVICES AND MATERIALS

- A. Outlet Boxes shall meet NEMA OS1 and be galvanized code gauge steel. Boxes in masonry shall be square cornered. Boxes exposed to weather or in wet locations shall be

Type FD cast metal with external threaded hubs and gasketed cover and shall meet NEMA FB1.

- B. Outlet box extensions shall be U.L. listed and shall be attached to box with threaded metal screws. "Flash Guards" are not permitted to be used as box extensions.
- C. Approved manufacturers of metal boxes are Circle AW, Crouse-Hinds, Steel City or equal.
- D. Receptacles:
 - 1. TVSS Receptacles:
 - a. TVSS Receptacles shall be Decora Plus duplex, straight blade, industrial grade, self-grounding, surge protected with indicator light, rated at 20 amperes, 125-volts.
 - b. TVSS Receptacles shall have integral TVSS with line-to-ground, line-to-neutral, and neutral-to-ground surge protection, with a nominal clamp level rating of 500 volts and minimum single transient pulse energy dissipation of 140 J line to neutral, and 70 J line to ground and neutral to ground.
 - c. TVSS Receptacles shall be Hubbell HBL5362WSA series, or equivalent.
 - 2. Receptacles for Owner-furnished equipment shall match that equipment's plug configuration.
 - 3. Other Receptacles: Other receptacles shall match the plug configuration and ratings required for the utilization equipment that is served.
- E. Device cover plates shall be provided and installed at all wiring devices, switches, outlets, and similar applications, and shall be as directed by owner. Pull boxes and junction boxes to which no fixture is to be attached shall be fitted with blank cover plates painted to match surrounding. All cover plates installed on rated walls shall be brushed stainless steel. Cover plates for receptacles in wet locations shall have an enclosure that is weatherproof whether or not the attachment plug cap is inserted and shall be identified as "extra-duty".

2.7 TERMINAL CABINETS AND CLOSETS

- A. Cabinets and fronts shall be in accordance with NEMA Standard Publication No. PB1-1971 and UL Standards No. 67. Fronts shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring loaded door pulls. The flush lock shall not protrude beyond the front of the door. All locks shall be keyed like the panel board locks. Fronts shall have adjustable indicating trim clamps that shall be completely concealed when the doors are closed. Doors shall be mounted by completely concealed steel hinges. Fronts shall not be removable with the door in the locked position. A frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge full finished steel with rust inhibiting primer and baked enamel finish.

2.8 SUPPORTING DEVICES

- A. Supporting devices shall be constructed of cold-formed steel, with a corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal items for use outdoors or in damp locations shall be hot-dipped galvanized steel.

- C. Slotted-steel channel supports shall have flanged edges turned toward the web, and 9/16-inch diameter slotted holes at a maximum of 2 inches on center, in the web.
 - 1. Channel thickness shall be selected to suit structural loading.
 - 2. Fittings and accessories shall be products of the same manufacturer as the channel supports.
- D. Raceway and cable supports shall be manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- E. Pipe sleeves shall be ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, with plain ends.
- F. Cable supports for vertical conduit shall be a factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs shall have number and size of conductor gripping holes as required to suit individual risers. Body shall be constructed of malleable-iron casting with hot-dip galvanized finish.
- G. Concrete anchors shall be steel bolts with expansion anchors requiring a drilled hole. Powder driven anchors are not acceptable.
- H. Toggle bolts shall be all-steel springhead type.

2.9 ELECTRICAL IDENTIFICATION

- A. Identification devices shall be a single type of product for each application category. Colors shall be as prescribed by ANSI A13.1, CEC, and these Specifications.
- B. Raceway and cable labels shall comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
 - 1. Pre-tensioned, wraparound plastic sleeves shall be a flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
 - 2. Preprinted, flexible, self-adhesive, vinyl labels shall have a legend, over-laminated with a clear, weather- and chemical-resistant coating.
 - 3. Color shall be black letters on orange background.
 - 4. Legend shall indicate voltage.
- C. Self-adhesive colored marking tape for raceways, wires and cables shall be vinyl tape, not less than 1 inch wide by 3 mils thick.
- D. Underground Warning Tape shall be vinyl tape, compounded for permanent direct-burial service, not less than 6 inches wide by 4 mils thick, embedded with a continuous metallic strip or core, brightly-colored, continuously-printed with a legend that indicates the type of underground line.
- E. Tape markers for wire shall be vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

- F. Color-coding cable ties shall be made of Type 6/6 nylon, be self-locking type and of colors to suit coding scheme.
- G. Engraved plastic labels, signs and instruction plates shall be made from black (or red as noted) Bakelite laminate engraving stock with a white core, punched or drilled for mechanical fasteners. It shall have a minimum thickness of 1/16-inch for signs up to 20 sq. in. and a minimum thickness of 1/8-inch for larger sizes.
- H. Interior Warning and Caution signs shall comply with 29 CFR, Chapter XVII, Part 1910.145 and shall be preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
- I. Exterior Warning and Caution signs shall comply with 29 CFR, Chapter XVII, Part 1910.145 and shall be weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. They shall be equipped with 1/4-inch grommets in each corner for mounting.
- J. Fasteners for nameplates and signs shall be self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
- K. Circuit Identification – A typewritten circuit directory shall be provided at each panelboard and switchboard in accordance with CEC Article 408.4(A). The Contractor shall develop and prepare the circuit identification description based on the as-built condition.

2.10 TOUCHUP PAINT

- A. Touch-up paint shall be equipment manufacturer's paint selected to match installed equipment finish.
- B. Touch-up paint on galvanized surfaces shall be zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL INSTALLATION

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site throughout the construction of the project.
- B. The layout and installation of electrical work shall be coordinated with the overall construction schedule to prevent delay in completion of the project.
- C. Dimensions and information regarding accurate locations of equipment and structural limitations and finish shall be verified with other sections.

- D. The drawings do not show all raceway, wiring, offsets, bends, special fittings, junction or pull boxes necessary to meet job conditions. Items not shown as indicated, where are clearly necessary for proper operation or installation of systems shown, shall be provided as required, at no increase in contract price.
- E. Materials and Components shall be installed level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- F. Electrical equipment, outlets, junctions and pull boxes shall be installed in accessible locations, avoiding obstructions, preserving maximum headroom, and keeping openings and passageways clear.
- G. Equipment shall be installed to facilitate service, maintenance, and repair or replacement of components. It shall be connected for ease of disconnecting, with minimum interference with other installations. Minor adjustments in the locations of equipment shall be made where necessary providing such adjustments do not adversely affect function of the equipment. Major adjustments for the location of equipment shall be previously approved and detailed on the Record Drawings.
- H. Right of Way shall be given to raceways and piping systems installed at a required slope.

3.2 PRECAST CONCRETE PULL BOXES AND MANHOLES

- A. Contractor shall provide a minimum of 3-6" of sand base material suitable to receive the pullbox or manhole. The base material shall be compacted and graded level at proper elevation to receive the pullbox or manhole in relation to the conduit grade or ground cover requirements as designated in the plans.
- B. Sealants used between the joints of the pullbox or manhole are at the Contractor's discretion unless otherwise specified. If grout is used, it should consist of two parts plaster sand to one part cement with sufficient water added to make the grout flow under its own weight. The grout should be poured into a water soaked groove and filled to the top of the groove unless a double amount is to be used as a further precaution against leakage. In this case, the mastic sealant should be placed on the two shoulders of the groove. The next section of pullbox or manhole should be placed while the foaming action is in process. Contractor shall verify grades with the Engineer and shall set holes and boxes level at proper grades.
- C. All conduits penetrating the pull box or manhole shall have seals to prevent water from entering the raceway.

3.3 RACEWAY APPLICATION

- A. Wiremold 4000 Series one-channel surface metallic raceway shall be used as called for to distribute data and low voltage system signals.
- B. Wiremold 3000 Series one-channel surface metallic raceway shall be used as called for to distribute data and low voltage system signals.
- C. Wiremold 2400 Series one-channel surface metallic raceway shall be used as called for to distribute data and low voltage system signals.

- D. Wiremold 500 Series one-channel surface metallic raceway shall be used as called for to distribute branch circuits.
- E. A complete system of surface raceways including all fittings and covers shall be installed as required to continuously route raceways around corners, transition between and route down walls, and provide all device terminations. Retaining clips shall be installed such that wiring and cabling shall be retained within the raceway when the cover is removed. All raceway fittings shall be specifically designed for the raceway type with which used. Raceways shall be listed by Underwriters Laboratories Inc.
- F. Galvanized Rigid Steel Conduit (GRC) **may** be used in all locations. Where installed in direct contact with earth, conduit shall be wrapped with two layers of half-lapped 10-mil PVC tape for a total thickness of 40-mil or have a factory applied 40-mil PVC coating.
- G. Galvanized Rigid Steel Conduit (GRC) **shall** be used where exposed to physical damage, indoors where exposed to moisture, in exposed outdoor installations, in systems higher than 600 volts, and where required by code.
- H. Galvanized Intermediate Metallic Conduit (IMC) **may** be used in indoor locations not in direct contact with earth.
- I. Galvanized Electrical Metallic Tubing (EMT) may be used in dry indoor locations according to the following criteria:
 - 1. It is not subject to physical damage.
 - 2. It is not in direct contact with earth.
 - 3. It is not in concrete slabs.
 - 4. It is not in a hazardous area.
- J. Rigid Non-Metallic Conduit (RNC) Schedule 40 PVC **may** be used underground or below concrete slabs on grade. Rigid Non-Metallic Conduit (RNC) Schedule 80 PVC **may** be used to pass through concrete slabs. Rigid Non-Metallic Conduit (RNC) **may** be used in compliance with utility company requirements for utility service conduits. Rigid Non-Metallic Conduit (RNC) **shall not** be installed above grade or above finished floor level.
- K. Liquid-tight Flexible Metallic Conduit (LFMC) **may** be used where specifically approved by the Engineer, LFMC may be used to facilitate wiring in tight locations or in other conditions that make the use of other conduit impracticable.
- L. Flexible Metallic Conduit (FMC) **may** be used where specifically approved by the Engineer, FMC may be used to facilitate wiring in tight locations or in other conditions that make the use of other conduit impracticable.

3.4 RACEWAY INSTALLATION

- A. General
 - 1. Expansion joints shall be provided at building expansion joints or as required due to length of run or difference in temperatures.
 - 2. All fittings that are exposed or in damp areas shall have sealing glands and proper gasket.

3. In general, all conduits shall be sloping to drain. Bends that place a trap in a conduit shall be avoided. Provided drip fitting as required. Dux-Seal high ends of all underground raceways.
4. All conduit runs shall be mechanically and electrically continuous from outlet to outlet. Conduit size or type shall not be changed between outlets.
5. All empty raceways shall be equipped with pull lines, capped and labeled. Pull lines shall be 3/16" polypropylene, No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 24 inches of slack with identification tag at each end of the pull wire.
6. Minimum size of any conduit for power and signal shall be 3/4" conduit unless shown otherwise.
7. Use temporary raceway caps to prevent foreign matter from entering. Immediately prior to installation of conductors, conduit shall be blown and swept free of foreign materials. All conduit stubs for future, both above and below grade, shall be capped. Run conduits for spare panelboard circuits to attic or accessible spaces.
8. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
9. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.
10. There shall be no more than the equivalent of four quarter bends (360-degrees total) between pull points such as pull boxes, outlet boxes or conduit bodies, in one run of conduit.
11. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
12. Conduits shall be securely fastened to building structure at intervals not greater than ten feet.
13. Conduit shall be square cut and reamed if required to full size, with thread full cut and true.
14. Conduits shall be jointed by approved couplings with ends of conduits tightly butted. Non-insulating compound shall be used in making up joints below grade or inside on grade to insure a watertight system.
15. Conduit connections to outlet boxes or cabinets shall be made with approved connectors, using locknuts and insulated throat bushings.
16. Complete raceway installation before starting conductor installation.
17. Contractor shall provide rubber grommets to fasten galvanized conduit to exterior structures made of dissimilar metals at all exterior locations to prevent galvanic corrosion.
18. Contractor shall provide rubber grommets to fasten galvanized conduit to supports which are also used by other systems utilizing piping of dissimilar metals to prevent galvanic corrosion.

- B. Interior
 - 1. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
 - 2. All concealed conduits shall be installed in as direct a line as possible between outlets. No more than four quarter bends, or their equivalent, will be allowed between outlets. Feeder conduits shall follow arrangement shown on plans unless a change is authorized. Branch circuit conduits shall, in general, follow arrangement as shown as far as structural conditions permit. All exposed runs shall parallel buildings, walls, or partitions, and be supported on Kindorf Hangers to meet Title 24, Part 3, CEC.
- C. Exterior
 - 1. Exterior conduit including the sweep below grade and the vertical riser shall be galvanized rigid steel conduit, except where rigid non-metallic conduit is required for utility service conduits by the serving utility company.
 - 2. No rigid non-metallic conduit (RNC) shall be installed above grade.

3.5 SURFACE MOUNTED RACEWAY INSTALLATION

- A. Surface Mounted Raceways shall be used to provide raceway systems for branch circuits and data network voice, video and other low-voltage wiring.
- B. Surface Mounted Raceways shall be used only in dry interior locations, as allowed in Article 388 (Surface Nonmetallic Raceways) of the California Electrical Code.
- C. Surface Mounted Raceways and wire distribution systems shall contain no more than six current carrying conductors in each section or compartment. Where additional conductors are required, additional raceway shall be installed to accommodate additional conductors.
- D. Electrical and mechanical rooms are specifically excluded from the use of non-metallic Surface Mounted Raceways.

3.6 CONDUCTOR APPLICATION

- A. Feeders and branch circuits shall be Type THHN/THWN insulated conductors in raceway.
- B. Underground feeders and branch circuits shall be Type THWN or single-wire, Type UF insulated conductors in raceway.
- C. Branch circuits shall be Type THW or THHN/THWN insulated conductors in raceway.
- D. Minimum conductor size shall be #12 for power, #14 for 120V control circuits and #18 for 24V control circuits.
- E. Remote control, signaling and power-limited circuits shall be Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.7 CONDUCTOR INSTALLATION

- A. Conductors shall be continuous from outlet to outlet, no splices shall be made except within outlet or junction boxes.
- B. Wiring at outlets shall be installed with at least 12 inches of slack conductor at each outlet.
- C. Outlet and component connections shall be made to wiring systems and to ground. Electrical connectors and terminals shall be tightened according to manufacturer's published torque-tightening values. Torque values specified in UL 486A shall be used where manufacturer's torque values are not indicated.
- D. Wire in panels, cabinets, pull boxes, and wiring gutters shall be squared, labeled, and neatly grouped with cable ties and fanned out to the terminals.
- E. All branch circuits, fixture wiring joints, splices, and taps for conductors #10 and smaller shall be made with 3M "Scotchlock" connectors, or approved equal.
- F. All branch circuits, fixture wiring joints, splices, and taps for conductors #8 and larger shall be made with two-bolt type solderless connectors or T & B "color keyed" compression lugs.
- G. Bolt-type solderless connectors shall be torqued with a torque wrench according to the manufacturer's recommendations, and then retightened after 24-48 hours before taping. Owners' inspector shall be informed of this procedure during the waiting period and shall witness the act of retightening.
- H. Connectors and lugs for terminating stranded conductors #8 and larger shall be machine crimp compression type.
- I. All splices shall be taped with Scotch #88 plastic electrical tape with "Scotch Fill" where necessary for a smooth joint. Scotch #27 or #2520 shall be used for other than normal temperatures or conditions. All connections and splices shall be electrically perfect and in strict accordance with all code requirements.
- J. No splices shall be made below grade in a manhole or pullholes without Engineer's written approval, and then shall be encapsulated with 3M potting kits per 3M Specifications. For larger gauge wire where 3M potting kits are prohibited Contractor shall use submersible UL listed Polaris connectors by NSi.

3.8 WIREWAY AND AUXILIARY GUTTER APPLICATION

- A. Wireways and auxiliary gutters shall be used above and below panelboards, and terminal cabinets to accommodate large concentrations of wires.

3.9 PULL BOXES AND WIREWAYS:

- A. Boxes shall be installed square and plumb. An engraved nameplate shall be installed on each box indicating its function. Nameplate shall be installed on the exterior of each box in unfinished areas and on the interior of each box in finished areas.
- B. Wireways shall be installed with strip-type connectors with self-retained mounting screws. Hangers with two piece, hook together features shall be used to permit preassembly of wireway and hanger bottom plate before hanging on a preinstalled upper bracket.

- C. Pull and junction boxes shall be installed as shown to ease the pulling of wire and to comply with CEC requirements.

3.10 WIRING DEVICES AND MATERIALS

- A. Outlets shall be mounted at 18" minimum above finished floor unless otherwise noted.
- B. The locations of outlets shown on drawings shall be located with respect to work of others and to be symmetrical with room layout.
- C. Outlets in architectural patterned surfaces such as tile and finish panels shall be centered on intersections of four panels or in exact center of panels.
- D. Outlet boxes for concealed work shall be one-piece steel knock out type with zinc coating. Boxes shall not be smaller than 4" square nominal size, unless otherwise indicated. Extension rings, plaster rings, and covers shall be provided as necessary for flush finish.
- E. The Contractor shall inform himself of wall thickness throughout the building and shall provide outlet boxes of suitable depth that can be flush mounted and yet will be deep enough to contain the particular apparatus involved. Location of exposed pull or junction boxes will be subject to the Owner's approval.
- F. Outlet boxes on opposite sides of walls shall not be placed back-to-back, nor shall "through" boxes be employed (except where specifically permitted on the drawings by note).
- G. Switches shall be mounted 48" to top of device box above finished floor unless otherwise noted.
- H. Where more than one switch occurs at the same location, use multiple gang outlet boxes covered by a single plate; provide box partitions as required by the N.E.C.
- I. Bar hangers shall be used to support outlet boxes in stud or furred partitions and ceilings. Attachment screws, devices, etc., shall be of the proper type to secure boxes to metal studs complemented by expansion shields to concrete and masonry.
- J. All outlet boxes and particularly those supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures, not from acoustic ceilings.
- K. Approved knock out holes shall be provided.
- L. Surface boxes of the cast metal threaded hub type with suitable gasketed covers shall be used for exposed conduit runs less than 5' above a finished floor or where waterproof boxes are required.
- M. Set floor boxes level and trim after installation to fit flush to finished floor surface.
- N. Masonry boxes shall have conduit entrances to rear of box with depth as required to clear masonry.
- O. Boxes shall be sized for number of conductors entering box.

- P. Wiring devices shall be securely fastened to the outlet box. Where the outlet box covers are back from the finished walls, the device shall be built out with washers so that it is rigidly held in place to the box. Metal extenders shall be provided in flammable construction per CEC.
- Q. All device screw slots shall be left in a vertical orientation.
- R. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor and to outlet box with bonding jumper.
- S. Connect ground terminal of isolated-ground receptacles to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

3.11 TERMINAL CABINETS AND CLOSETS

- A. Terminal cabinets shall be installed level and identified with nameplate per schedule.
- B. All conductors in terminal cabinets or closets shall be squared, labeled and secured neatly with wire ties.
- C. All terminal cabinets shall be installed with the top of the trim at 6'-0" above the finished floor, unless otherwise indicated on the drawings.
- D. Where space permits, terminal cabinets shall be surface mounted where they are not visible to the public.
- E. A typewritten directory shall be mounted behind plastic in a metal holder welded to the inside of each terminal cabinet door showing a complete description of terminations in each cabinet.

3.12 SUPPORTING DEVICE APPLICATION

- A. Hot-dip galvanized materials or nonmetallic channel and angle system components shall be used in damp locations and outdoors.
- B. Steel materials shall be used in dry locations.
- C. Support clamps for PVC raceways shall be click-type clamp system.
- D. Strength of supports shall be adequate to carry present and future loads, times a safety factor of at least four with a minimum of 200-lb design load.

3.13 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, according to the following criteria, unless otherwise noted:
 - 1. Wood – wood screws or screw-type nails.
 - 2. Masonry – toggle bolts on hollow masonry units, expansion bolts on solid masonry units.
 - 3. New Concrete – concrete inserts with machine screws and bolts.
 - 4. Existing Concrete – expansion bolts.
 - 5. Steel – welded threaded studs or spring-tension clamps on steel. Field welding shall comply with AWS D1.1. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 6. Light Steel – sheet-metal screws.
 - 7. Fasteners shall be selected so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.14 ELECTRICAL IDENTIFICATION

- A. Each conductor of every system shall be permanently tagged in each panelboard, pull box, J-box, etc., in compliance with the Occupational Safety and Health Administration (OSHA).
- B. Brady labels shall be used to identify terminals and destination of feeders, branch circuits, signal and control circuits, etc., at all terminations, junction boxes and pull boxes, and shall be coordinated with the nameplates in all boxes and equipment.
- C. All terminals in the switchboards, panels, relays, switches, devices, starter terminals, etc., shall have Brady labels for identification to identify both ends of all wiring.
- D. The Contractor shall furnish and install 1" x 3" x 3/32" thick laminated black Bakelite nameplates with a white core (unless specifically shown as red) engraved to produce white letters on black background for all items of electrical equipment, including 2-pole and 3-pole circuit breakers, panelboards, starters, relays, time switches and disconnect switches.
- E. All devices shall have their branch circuit identified on the back side of device plate with a permanent type black marker, i.e. CT A-21. Identify panelboard and circuit number from which receptacles are served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.
- F. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- G. Panels having single-pole circuit breakers shall be provided with typed schedules mounted in welded metal holders behind plastic.
- H. Clean surfaces that are to receive self-adhesive identification products before applying.
- I. Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
- J. Identify raceways and cables with color banding as follows:
 - 1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 - 2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
 - 3. Colors: As follows:
 - a. Security System: Blue and yellow.
 - b. Telecommunication System: Green and yellow.
- K. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- L. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power

and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

M. All power conductors shall be identified in accordance with the following schedule:

1. 120/208V, 3 Phase, 4 Wire System.

a. Phase A: Black.

b. Phase B: Red.

c. Phase C: Blue.

d. Neutral: White.

e. Ground: Green

2. 120/240V, 3 Phase, 4 Wire System.

a. Phase A: Black.

b. Phase B (Stinger): Orange.

c. Phase C: Blue.

d. Neutral: White

e. Ground: Green

3. Isolated ground conductor shall be green with a yellow stripe.

N. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

O. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.15 FIRESTOPPING

A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration, either before, during, or after the fire. The fire **and** temperature ratings of the penetration assembly shall be at least that of the floor, wall, or ceiling into which it is installed so that the original fire rating of the floor or wall is maintained as required by Article 300.21 of the California Electrical Code (CEC).

B. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs and similar structures. Where applicable, provide Hilti fire barrier sealing penetration system, and/or 3M fire barrier sealing penetration system, and/or STI fire stop system, including wall wrap, partitions, caps and other accessories as required. All manufacturers' instructions and recommendations for installation of sealing fittings and barrier sealing systems.

- C. The Contractor shall repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed new structures, surfaces and shall install new fireproofing where existing firestopping has been disturbed. The repair and refinishing of materials and other surfaces shall be by skilled mechanics of the trades involved.

3.16 REFINISHING AND TOUCHUP PAINTING

- A. The Contractor shall clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location. He shall follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
- B. Damage to galvanized finishes shall be repaired with zinc-rich paint recommended by manufacturer.
- C. Damage to PVC or paint finishes shall be repaired with matching touchup coating recommended by manufacturer.
- D. See Section 09900, "Painting".

END OF SECTION 26 05 00

SECTION 27 20 00
COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

- A. Furnish and install horizontal cable links between outlets and the corresponding building IDF/MDF, patch panels, outlet boxes, conduits and raceways, jack modules for terminating both ends of each cable, and coverplates.
- B. The Contractor shall provide termination, testing and certification of each cable.
- C. The furnishing of network servers and switches is specifically excluded from this section.

PART 2 - PRODUCTS

2.1 COMMUNICATION HORIZONTAL CABLING

- A. Horizontal Data Cable – For Connection of Video Surveillance System to the Local Area Network:
 - 1. Materials – 23 AWG solid copper UTP, 4-pair, CMP rated, premium Category 6 cable. Color: Yellow.
 - 2. Manufacturer – Berk-Tek
 - 3. Model: LANmark-1000 series.

2.2 COMMUNICATION HORIZONTAL CABLE TERMINATIONS

- A. Horizontal Data Cable Patch Panels
 - 1. Materials – 48-port, 2U Category 6 patch panel, fully loaded with Mini-com TX6 Jack modules. Rack-mountable (19") w/ integrated rear cable management bar. Color: Black.
 - 2. Manufacturer – Panduit (P/N DP486X88TGY)
- B. Data Outlets
 - 1. Station Jack Modules – Materials – 8-position RJ45, Category 6 rated jack modules. Color: Yellow. Manufacturer – Panduit (P/N CJ688TGYL). Quantity – Three (3).
 - 2. Outlet Box and Faceplate - Materials - 4 or 6-port, single-gang angled faceplate shall be mounted to a two-gang outlet box fitted with a single-gang reducer. Blanks shall be installed in each unused port. Panduit (Mini-com Series 4 or 6 modules).
 - 3. Surface Mount Outlet Box - Materials - 4-port, surface mount enclosure shall be mounted with a mechanical fastener. Blanks shall be installed in each unused port. Panduit (P/N CBX4IG-AY).

2.3 COMMUNICATIONS PATCH CORDS

- A. Horizontal Data Cable – For Connection of Video Surveillance System to the Local Area Network:
 - 1. Materials – 24 AWG solid copper UTP, 4-pair, CM rated, premium Category 6 cable. Color: Yellow.
 - 2. Manufacturer – Berk-Tek
 - 3. Model: UTPSP#YLY. Length as required.
 - 4. Qty. – (2) per horizontal cable installed.

2.4 LABELS

- A. Materials: Vinyl plastic type that meet UL 969 requirements, preprinted or laser printed type, and easily distinguishable.
- B. Manufacturers – Panduit, W.H. Brady, Ideal.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. The Contractor shall install all cables, trays, supports, racks, cabinets, frames, backboards, blocks, cable management, connectors, manhole cable rack hardware, and all appropriate termination and mounting hardware.
- B. The Contractor shall utilize conduits and cable trays for the placement of voice and data backbone cables.
- C. The Contractor shall utilize conduits and cable trays for the placement of horizontal voice and data cables. Cables which exit cable trays shall be supported by J-hooks that are attached to the structure independently from ceiling or lighting fixture supports.
- D. Where penetrations through fire rated walls, acoustical or other walls are made for cable pass-thru, such penetrations shall be sealed by the Contractor in compliance with code requirements.

3.2 BONDING AND GROUNDING

- A. The Contractor shall provide ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, conduit, cable trays, and framework. All grounds shall consist of #6 AWG stranded copper wire and shall be attached to an approved building ground, which is bonded to the main electrical ground. Grounding shall be in accordance with J-STD-607-A, NEC, NFPA and all local codes and practices.

3.3 IDENTIFICATION & LABELING

- A. The Contractor shall obtain the room numbers that will appear on door signage prior to assigning origin and destination identification for labels.
 - 1. Backbone cables shall be labeled at each endpoint and at all pull boxes, access points or junction boxes. Labels shall indicate origination and destination identification, sheath identification, and strand or pair count.
 - 2. Horizontal cables shall be labeled at each endpoint. Labels shall indicate origination and destination identification.
 - 3. All label printing will be machine generated by system software using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end

3.4 ACCEPTANCE TESTING AND CERTIFICATION

- A. All distribution cables shall meet or exceed all performance specifications designated by ANSI/EIA/TIA-568-B.1, and IEEE for telephone and data communications.
- B. No later than five days after testing, Contractor shall furnish the Owner with a documentation binder and electronic disks of all test results from OTDR and power meter test equipment. Electronic copies of test results must be presented in format acceptable to the Owner (runtime software application included if necessary). The content requirements for these forms are described in the following sections.
- C. Copper Cables: Testing of all copper wiring shall be performed prior to system cut-over. 100 percent of the OSP and horizontal wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage. Test shall include length, mutual capacitance, characteristic impedance, attenuation, and near-end and far end cross-talk. The Contractor, at no charge shall bring any pairs not meeting the requirements of the standard into compliance with the standards and specifications. Complete, end to end test results must be submitted to the Owner. Test results for each of the above tests and associated cable lengths shall be generated by an automated testing device. Test results must be permanently recorded and presented for review in both hardcopy and in a computer-readable format.

3.5 PROJECT RECORD DOCUMENTATION

- A. The Contractor shall provide a database of cable records, both hard copy and on floppy disk, using Owner approved format (Excel spreadsheet or otherwise specified) for use by the Owner for cable and facilities management. The cable records format must include, at a minimum, the following information about each cable:
 - 1. Distribution Cable Pair Assignments.
 - 2. Test Results.
- B. Three (3) sets of reproducible as-built floor plans plus vertical rack elevations and wall mounted termination field details in digital format (AutoCAD v.14) showing all installed cables, pair and strand assignments, routing, terminal and outlet locations, patch panels and labeling conventions.
- C. These documents shall be delivered to the Owner no more than 20 working days after completion and acceptance of the Contractor's work.

END OF SECTION 27 20 00

SECTION 28 20 00

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SCOPE

- A. Basis of Design for the Security Camera system: The security camera system design is primarily based on the use of a dual high definition and analog video output with full HD 1080p resolution and digital video recording system that is connected to the local area network.
 - 1. The Contractor's scope of work shall include the following:
 - a. Provide, install, connect and test the following items: DVR enclosures including rail kits and fan guards, conduit, junction boxes, outlet boxes, pull cans, blocking at locations of LCD monitors, connectors and cabling associated with the security camera system. Provide and install 120-volt, 20-amp branch circuits and duplex TVSS type receptacles at DVR equipment and LCD monitor locations.
 - b. Install, connect and test the following Owner furnished items: Mounting brackets and adapters, cameras, power supplies, DVRs, HD-SDI to HDMI converters, LCD monitors with wall mount brackets, and HD-SDI & RS485 to Fiber Transmitters and Receivers.
 - c. Test continuity of all wiring associated with the security camera system.
 - d. Walk each camera location with a FUSD electronics shop representative to adjust individual camera settings after all cameras are installed and powered on and prior to final walk through.
 - e. Notify FUSD when the security camera system is ready for programming so that the FUSD electronics shop representative may perform programming.
 - f. A completely installed, operational and fully functional security camera system and video recording system.

1.3 COORDINATION

- A. Confirm interface of the digital security system with local area network and telephone system. Report discrepancies to the Owner or Electrical Engineer.

- B. Coordinate to avoid conflicts between supports, fittings, mechanical equipment and lines of sight for the camera operation. Photograph lines of sight for each camera location and meet and review with the Owner prior to camera installation.

1.4 SUBMITTALS

- A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Division 16 Specification Sections.
- B. Shop Drawings:
 - 1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
 - 2. Show exact location of all devices, including cameras and DVRs.
 - 3. Riser diagram including floor and building level details. Include camera cable specification. Illustrate points of connection to integrated systems.
- C. Product Data: Catalog sheets, specifications and installation instructions.

1.5 QUALITY ASSURANCE

- A. All electrical and electronic components, devices and accessories shall be listed with Underwriters Laboratories, Inc. (or other testing agency acceptable to authorities having jurisdiction), shall meet their requirements, shall bear their label wherever standards have been established and label service is regularly furnished by that agency, and shall be marked for intended use.

1.6 CODES AND STANDARDS

- A. All work and materials shall fully comply with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications shall be interpreted as to permit any work not in compliance with these codes. Where work is detailed and/or specified to a more restrictive standard or higher requirement, that standard or requirement shall govern such work. Installation shall comply with the following codes and standards:
 - 1. California Code of Regulations (CCR)
 - a. Title 8, Industrial Relations
 - b. Title 17, Public Health
 - c. Title 24, Building Standards
 - 2. 2019 California Building Code
 - 3. 2019 California Fire Code
 - 4. 2019 California Electrical Code
 - 5. 2019 NFPA 72
 - 6. Local Codes.

7. UL 467 Grounding and Bonding Equipment
8. UL 365 Police Connect Burglar
9. UL 609 Local Burglar
10. UL 1023 Household Burglar Alarm System Units
11. UL 1076 Proprietary Burglar
12. UL 1610 Central Station Burglar Alarm Units
13. UL 1635 Digital Burglar Alarm Communicator System Units
14. DCID 6/9
15. DoD/NIST SCIF Standards

1.7 WARRANTY

- A. The **Warranties** specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Provide five-year manufacturer's warranty on all wiring.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. This security camera system design is based on the use of camera and DVR equipment manufactured by Clinton Electronics.

2.2 CAMERAS AND EQUIPMENT (OWNER FURNISHED AND CONTRACTOR INSTALLED)

- A. The following camera system devices and equipment shall be furnished by the Owner and installed, connected and tested by the Contractor:
 1. Digital Video Recorder (DVR)
 - a. Clinton Model CE-HDVR16/30tb;
 2. Cameras
 - a. Clinton Model CE-VX2HD, IR Vandal X + heaters (white)
 3. Mounting Brackets
 - a. Clinton Model CE-VXWB Vandal X Wall Bracket (white)
 4. Four Inch Square Surface Box Adapter Plate
 - a. Clinton Model VXAP
 5. LCD Monitors

- a. Clinton Model CE-VT420-NB-HD - 42" LCD Monitor no base, with wall mounting bracket

6. Power Supplies

- a. Clinton Model CE-AC24V16 16 camera 24VAC power supply

2.3 CAMERAS AND EQUIPMENT (CONTRACTOR FURNISHED AND CONTRACTOR INSTALLED)

- A. The following camera system devices and equipment shall be furnished, installed, connected, and tested by the Contractor:

1. Digital Video Recorder Lockbox (Enclosure)

- a. Middle Atlantic Products Model DLBX-series with Rackrail DLBX-RR5, Security Kit DLBX-FSK and Fan Kit FC-2-215-1CA; and Orion G109-15A Fan Guard

2.4 CONDUIT AND WIRING

A. Conduit –

- 1. Camera system cable and wiring shall be in EMT type conduit where run exposed indoors or RMC type conduit where run exposed outdoors. Refer to Specification Section 16050 for conduit specifications.
- 2. Camera system cable and wiring may be run free air supported by J hooks where concealed above accessible attic spaces or above suspended ceilings.

B. Wiring –

- 1. Wiring shall be PTZ (CCTV + Power/Audio) Cable, Rated-CMG, 1-RG6-18 AWG solid bare copper with foam polyolefin, 95% bare copper braid, 2-18 AWG stranded-bare copper conductors with 300-volt rated polyolefin insulation, with overall PVC jacket of overall nominal diameter of 12.319 mm, RG Type 6/U, 75 Ohm, 0.318 Inductance, 53.48 nom. capacitance conductor to shield, and 83.0% Velocity of Propagation. Twisted red/black pair, 1.168 mm diameter of #18 AWG bare copper, NEC rated, NEC Article 800, UL 1685 Flame Test FT1. RoHS compliant. Belden model: 539945 0101000_RG6+2C18 CMG SIAM.

C. J Hooks

- 1. J hook cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed. J hook cable supports shall have flared edges to prevent damage while installing cables. J hook cable supports shall be 1 5/16" minimum and have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces. J hook cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
- 2. Manufacturer – Erico (Caddy Cablecat Series Non-continuous Support Cable System).

2.5 CABLE TERMINATIONS

- A. RG6 Coaxial Cable Terminations:
 - 1. Materials – BNC type compression connectors, one piece, 360-degree compression, gold plated, weatherproof seal.
 - 2. Manufacturer – Belden DB68NCU
- B. Composite Cable Auxiliary/Power Terminations: Auxiliary/Power shall be terminated directly to set screw wire terminals.

2.6 LABELS

- A. Materials: Vinyl plastic type that meet UL 969 requirements, preprinted or laser printed type, and easily distinguishable.
- B. Manufacturers – Panduit, W.H. Brady, Ideal.

PART 3 - EXECUTION

3.1 ELECTRICAL INSTALLATION

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance, with FUSD point of contact approval. Manufacturer's installation instructions shall be delivered to and maintained at the job site throughout the construction of the project.
- B. The layout and installation of electrical work shall be coordinated with the overall construction schedule to prevent delay in completion of the project.
- C. Each camera device shall be connected to a dedicated zone.
- D. Dimensions and information regarding accurate locations of equipment and structural limitations and finish shall be verified with other sections.
- E. The drawings do not show all raceway, wiring, offsets, bends, special fittings, junction or pull boxes necessary to meet job conditions. Items not shown as indicated, where are clearly necessary for proper operation or installation of systems shown, shall be provided as required, at no increase in contract price.
- F. Materials and Components shall be installed level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- G. Electrical equipment, outlets, junctions and pull boxes shall be installed in accessible locations, avoiding obstructions, preserving maximum headroom, and keeping openings and passageways clear.
- H. Equipment shall be installed to facilitate service, maintenance, and repair or replacement of components. It shall be connected for ease of disconnecting, with minimum interference with other installations. Minor adjustments in the locations of equipment shall be made where necessary providing such adjustments do not adversely affect function of

the equipment. Major adjustments for the location of equipment shall be previously approved and detailed on the Record Drawings.

- I. Right of Way shall be given to raceways and piping systems installed at a required slope.
- J. All cables shall be labeled at both ends with vinyl cloth printed wire marker (Brady #PWM-PK-1). Label shall identify the room number where the device is located.
- K. All devices shall be provided a white sticky back label adhered to the front of the device with the device address typed black in color in 3/8" font.
- L. All cables shall be neatly bundled together and dressed in a terminal cabinet.
- M. Conductors shall be terminated in the following orders:
 - 1. 1) Black; 2) Red; 3) Green; 4) White
- N. Contractor shall walk each camera location with a FUSD electronics shop representative to adjust individual camera settings after all cameras are installed and powered on and prior to final walk through.
- O. Contractor shall notify FUSD when the security camera system is ready for programming so that the FUSD electronics shop representative may perform programming.

3.2 BONDING AND GROUNDING

- A. The Contractor shall provide ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, conduit, cable trays, and framework. All grounds shall consist of #6 AWG stranded copper wire and shall be attached to an approved building ground, which is bonded to the main electrical ground. Grounding shall be in accordance with J-STD-607-A, NEC, NFPA and all local codes and practices.

3.3 TESTING

- A. After installation of the camera system the Contractor shall perform testing of the complete camera system in the presence of the Owner and shall make adjustments to correct any system deficiencies.

END OF SECTION 28 20 00