



**Project:** Bear Creek High School Agricultural Science Building  
Increment 1

**Owner:** Lodi Unified School District  
1305 E. Vine Street  
Lodi, CA 95240

**Architect:** SVA Architects, Inc.  
7901 Stonebridge Dr., Pleasanton, CA 94588

## **ADDENDUM 2**

**Revision:** 01/22/2024

*Note: The following revisions and clarifications to the Contract Documents (plans and specifications) shall become a part of the Contract Documents. All bidders are required to incorporate all necessary changes, additions, or deductions into their proposals.*

### **1. PROJECT MANUAL**

- a. Section 26 00 00 General Electrical Specifications
  - i. Replace section 26 00 00 with the attached specification section 26 00 00.

### **2. PRE-BID QUESTIONS AND RESPONSES**

- 1. Q: How should the irrigation under the footprint of the new building be handled?

A: Refer to the attached reference drawings F5.00, F5.01, F5.02, F5.03, F5.04, F5.05, and F5.06 depicting the current irrigation system in the project area. Reconfigure the existing irrigation system to remove the irrigation system from the footprint of the new building as located in the contract documents. Provide a complete and fully functional irrigation system after reconfiguration. All irrigation components shall match the material standards noted in those reference drawings.

- 2. Q: The reference drawings for the building show hard connections to the storm drain, but there is not a storm drain connection shown for them. Please clarify.

A: Provide 8" SDR-35 from each of the downspouts to the storm drain to the north of the new building.

**Reason:** Revision & Clarification of Bid Documents

**Bear Creek High School Agricultural Science Building**

**Increment 1**

Addendum 2

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**Distribution:**

Bidders

Owner

Inspector

**Attachments:**

26 60 00 General Electrical Specifications

Sheet F5.00

Sheet F5.01

Sheet F5.02

Sheet F5.03

Sheet F5.04

Sheet F5.05

Sheet F5.06

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2022-40119 Inc 1 Addendum 2.docx

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SECTION 26 00 00

GENERAL ELECTRICAL SPECIFICATIONS

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**PART 1 – GENERAL**

1.1 WORK INCLUDED

- A. This specification shall apply to all phases of Work hereinafter specified, shown on Drawings, or as required to provide a complete installation of electrical systems for this Project. Work required under this specification is not limited to just the Electrical Drawings - refer to Architectural, Structural, Landscape, and Mechanical/Plumbing Drawings, as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.
  - 1. Work Included: Furnish labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.
  - 2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation and rough-in locations from the actual equipment or from the equipment shop drawings.
- B. Electrical Drawings: Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

1.2 QUALITY ASSURANCE

- A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:
  - 1. Institute of Electrical and Electronic Engineers - IEEE
  - 2. National Electrical Manufacturers' Association - NEMA
  - 3. Underwriters' Laboratories, Inc. - UL
  - 4. National Fire Protection Association - NFPA
  - 5. Federal Specifications - Fed. Spec.
  - 6. American Society for Testing and Materials - ASTM
  - 7. American National Standards Institute - ANSI

8. National Electrical Safety Code - NESC
  9. Insulated Cable Engineers Association - ICEA
  10. American Institute of Steel Construction - AISC
  11. State and Municipal Codes In Force In The Specific Project Area
  12. Occupational Safety and Health Administration (OSHA)
  13. Electronics Industries Association/Telecommunications Industry Association (EIA/TIA)
  14. California Electrical Code - CEC
  15. Local Authority Having Jurisdiction (AHJ) Published Electrical Standards and Codes
- B. Perform Work in accordance with the National Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.
1. Comply with all requirements for permits, licenses, fees and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.
  2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

### **1.3 GENERAL REQUIREMENTS**

- A. Guarantee: Furnish a written guarantee for a period of (1) one-year from date of acceptance.
- B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.
- C. All Core Cutting, Drilling, and Patching:
1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.
  2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer and DSA Approval.

3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.
4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.
5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.

**D. Verifying Drawings and Job Conditions:**

1. The Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.
2. The Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

**1.4 WORK IN COOPERATION WITH OTHER TRADES**

- A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.
- B. Provide a conduit-only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits, and backboxes required for installing conductors to the controls.
- C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

**1.5 TESTING AND ADJUSTMENT**

- A. Upon completion of all electrical work, the Contractor shall test all circuits, switches, light fixtures, lighting control and dimming systems including distributed systems, UPSs, generators, SPDs, lighting inverters, transfer switches, motors, circuit breakers, motor starters and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.
- B. Equipment and parts in need of correction and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.

- C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.
- D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

## **1.6 IDENTIFICATION**

- A. Nameplates shall be provided for unit substations, switchgear, switchboards, distribution boards, distribution panels, panel boards, motor control centers, transformers, transfer switches, contactors, starters, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, fire alarm/central monitoring terminal cabinets/power supplies/control panels, and all low voltage system terminal and control cabinets.
  - 1. Nameplate inscriptions shall be identical to the equipment designations indicated in plans and specifications. Nameplates shall be engraved with the device designation/identification on the top line, source identification for the device on the 2nd line per CE, Art 408.4 and load designation for the device on the bottom line. Where load designation consists of a branch circuit, omit bottom line. Where device designation is not indicated on plans/specifications, Contractor shall submit a written clarification request to the Engineer.
    - a. Example: Transformer 1TA
      - 1) Source Disconnecting Location: Switchboard MSA located in Rm 110
      - 2) Load: Panels 1LA and 1 LB
  - 2. All circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDU sub-feed circuit breakers and motor control centers shall have individual nameplates located immediately adjacent to the respective device. Nameplate inscription shall identify the downstream equipment or device served by the circuit breaker or fuse.
- B. Identification nameplates, UON, shall be laminated/extruded modified acrylic that is 3/32" thick, UV-stabilized, matte finish, suitable for use in 180 deg. F ambient, with beveled edges and engraved white letters 3/8" high, minimum, on 1-1/2" high black background (utility/normal and optional standby power systems) for single line of text. Where two lines of text are required, provide minimum 2" high nameplate. Where three lines of text are required, provide minimum 2.5" high nameplate. Provide white letters on red background for all CEC Article 517 essential power systems, Article 700 Emergency Systems, Article 701 Legally required standby systems and Article 708 COPS.
- C. Identification nameplates for new switchgear, switchboards, distribution boards, distribution panels, panel boards and motor control centers shall be attached with switchgear manufacturer-provided screws via switchgear manufacturer factory pre-drilled holes. A factory option to rivet identification nameplates to the equipment is only acceptable if screw-fastened nameplates are not an available option from the

switchgear manufacturer. Field drilling or other mechanical attachment methods that change/void the NEMA or NTRL rating of the enclosure are strictly forbidden.

- D. Identification nameplates for transformers, transfer switches, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, terminal cabinets and all circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDUs, PDU sub-feed circuit breakers, and motor control centers shall be attached to the equipment by self-adhesive backing integral to the nameplates. When equipment is located outdoors, provide nameplates without self-adhesive backing and attach to equipment using weather-rated, UV-resistant epoxy. In all cases, clean surfaces before applying identification nameplates parallel to equipment lines.
- E. Warning Placards, as required by General Single Line Diagram Notes for multiple power sources, or instruction placards, as required for all kirk-key interlock schemes, all UPS bypass procedures or as required elsewhere in the plans/specifications shall be engraved 1/2" high white lettering on a red background using the same material specified for identification nameplates with a self-adhesive backing. Warning/instruction placards shall be attached to the face of the equipment directly related to the placards. Provide a formal placard submittal for review by the Engineer prior to ordering any warning/instruction placards. In all cases, clean surfaces before applying warning/instruction placards parallel to equipment lines.
- F. Receptacles that are part of a UL-listed under floor computer room whip assembly, ceiling and/or cable/ladder tray-mounted receptacles used in lab, manufacturing, commercial kitchen environments or that are serving telecom/data/AV racks and cabinets shall have identification nameplates located on the wiring device plate cover. Nameplates shall be self-adhesive, 3/32" thick Micarta with beveled edges, engraved 1/4" high white lettering on black background with serving power source, circuit identification and NEMA/IEC receptacle type. Use of two (2) separate nameplates per device plate cover is acceptable. Affix nameplates to be visible when plugs are occupying receptacles.
- G. See wiring device section of this specification for wiring device plate cover labeling requirements.
- H. See drawings for panel board schedule directory installation requirements.
- I. See conduit installation section of this specification for conduit labeling requirements.

#### **1.7 FINAL INSPECTION AND ACCEPTANCE**

- A. After all requirements of the Specifications and/or the Drawings have been fully completed; representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.
- B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

**1.8 RECORD DRAWINGS**

- A. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, the contractor shall provide a complete set of As-Built drawings. As-Built drawings shall be generated with the latest version of AutoCad and drawn to scale. Submit (1) electronic copy to the Architect with other close out documentation upon completion of project. Refer to the Supplementary General Conditions for complete requirements.

**1.9 APPROVALS, EQUALS, SUBSTITUTIONS, ALTERNATIVES, NO KNOW EQUAL**

- A. Approvals: Where the words (or similar terms) "approved", "approval", "acceptable", and "acceptance" are used, it shall be understood that acceptance by the Owner, Architect and Engineer are required.
- B. Equal: Where the words (or similar terms) "equal", "approved equal", "equal to", "or equal by", "or equal" and "equivalent" are used, it shall be understood that these words are followed by the expression "in the opinion of the Owner, Architect, and Engineer." For the purposes of specifying products, the above words shall indicate the same size, made of the same construction materials, manufactured with equivalent life expectancy, having the same aesthetic appearance/style (includes craftsmanship, physical attributes, color and finish), and the same performance.
- C. Substitution: For the purposes of specifying products, "substitution" shall refer to the submittal of a product not explicitly approved by the construction documents/specifications.
  - 1. Substitutions of specified equipment shall be submitted and received by the Engineer ten (10) days prior to the bid date for review and written approval. Regulatory Agency approval for all substitutions will be the sole responsibility of the Contractor. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letterform and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples, if requested, must be included in the submittal. **ONLY PRE-BID APPROVED PRODUCTS, ISSUED VIA A FORMAL BID ADDENDUM TO ALL BIDDERS, WILL BE ALLOWED ON THE PROJECT. REGARDLESS OF THE APPROVAL ON ANY SUBSTITUTION, ALL BIDS SHALL BE BASED ON THE PRODUCTS EXACTLY AS SPECIFIED. PRICING FOR EACH APPROVED SUBSTITUTION SHALL BE INCLUDED IN THE BID SUBMITTAL AS A SEPARATE LINE ITEM.**
  - 2. In the event that written authorization is given for a substitution, after award of contract, the Contractor shall submit to the Engineer quotations from suppliers/distributors of both the specified and proposed equal material for price comparison, as well as a verification of delivery dates that conform to the project schedule.

3. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.
  4. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.
- D. Alternates/Alternatives: For the purposes of specifying products, “alternatives/ alternates” may be established to enable the Owner/Architect/Engineer to compare costs where alternative materials or methods might be used. An alternate price shall be submitted in addition to the base bid for consideration. If the alternate is deemed acceptable, written authorization will be issued.
- E. No Known Equal: For the purposes of specifying products, “No Known Equal” shall mean that the Owner/Architect/Engineer is not aware of an equivalent product. The Contractor will need to submit a “Substitution” item, per the requirements listed above, if a different product is proposed to be utilized.

#### **1.10 SHOP DRAWINGS/SUBMITTALS**

- A. Shop Drawings/Submittals, unless required otherwise by general project specifications or instructions to bidders, shall be submitted in electronic format (PDF) to include a Letter of Transmittal (PDF), which shall give a list of the drawings submitted with dates and/or system(s) components contained within the submittal. Drawings and material cut sheets shall be complete in every respect and edited/marked to indicate specific items being provided. Printed/Hard copies are not acceptable.
- B. The Shop Drawings/Submittals shall be marked with the name of the project, numbered consecutively, and bear the approval of the Contractor as evidence that the Contractor has checked the Drawings. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.
- C. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor’s letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.
- D. Only products listed as “Equal” within the contract documents, along with formally approved “Substitutions” will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.
- E. Review comments used in response to shop drawings/submittals are:
1. “No Exception Taken” - Product approved as submitted.
  2. “Furnish as Corrected” - Re-submittal not required, although the Contractor shall provide the submitted product with corrections as noted.
  3. “Revise and Resubmit” - Re-submittal required with corrections as noted.
  4. “Rejected” - Re-submittal required based upon the originally specified product.

- F. Shop drawings shall be submitted on the following but not limited to:
1. Lighting Fixtures, Lamps, and Ballasts.
  2. Fire Alarm System/Central Monitoring System.
  3. Wiring Devices.
  4. Lighting Control System/Dimming System Products.
  5. Terminal Cabinets
  6. Arc Flash, Short-Circuit and Coordination studies.
  7. All other products called out on drawings that call for shop drawing submittal.

**1.11 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS**

- A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating, maintenance, and servicing instructions, as well as four (4) complete wiring diagrams for the following, but not limited to, items or equipment:
1. Lighting Control System/Dimming Systems.
  2. Fire Alarm System.
- B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

**1.12 INTERRUPTION OF SERVICE/SERVICE SHUTDOWN**

- A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc. required to perform work, shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.
- B. Interruptions/outages of any of the Owner's systems and services mentioned above shall be scheduled to occur during other than the Owner's normal business hours. Any overtime costs shall be borne by the Contractor.
- C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Materials and Equipment: All electrical materials and equipment, including custom-made equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ)

- B. Switchgear/Switchboards/Distribution Boards/Motor Control Centers:
1. See general single line notes on single line drawing for more information.
- C. Panel boards – Branch Circuit:
1. See drawings for panel board schedules and specifications.
- D. Lighting Fixtures:
1. See drawings for lighting fixture and lamp schedules and additional specifications. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure and lamps.
  2. Ballasts: See lighting fixture schedule notes. All noisy ballasts shall be replaced at no cost to the Owner.
  3. Lamps: See lamp/fixture schedule and lamp/lighting fixture schedule notes.
- E. Wiring Devices:
1. Provide wiring devices indicated per plan. Devices shall be specification grade. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell. Provide all similar devices of same manufacturer, unless indicated otherwise. All device colors shall be from the full range of manufacturer standard color options as selected by the Architect. This selection will be made during the shop drawing review process
    - a. Wiring Devices (Decora)

1) Convenience Receptacle	#16252- ???
2) Dedicated Receptacle	#16352-???
3) Convenience I.G. Receptacle	#16262-IG-???
4) Dedicated I.G. Receptacle	#16362-IG-???
5) Convenience G.F.C.I. Receptacle	#GFT1-???
6) Dedicated G.F.C.I. Receptacle	#GFNT2-???
7) Convenience Hospital Grade Receptacle	#16252-HG?-???
8) Dedicated Hospital Grade Receptacle	#16352-HG?-???
9) Convenience G.F.C.I. Hospital Grade	#GFNT1-HG?
10) Dedicated G.F.C.I. Hospital Grade	#GFNT2-HG?
11) Tamper Resistant Convenience Receptacle	#TDR15-???
12) Tamper Resistant Dedicated Receptacle	#TDR20-???
13) Tamper Resistant GFCI Receptacle	#GFTR2-???
14) Tamper Resistant. Convenience. G.F.C.I. Hospital Grade Receptacle	#GFTR1-HG?
15) Tamper Resistant. Dedicated. G.F.C.I. Hospital Grade Receptacle	#GFTR2-HG?
16) Weather/Tamper Resistant GFCI Receptacle	#GFWT2-???
17) Convenience Simplex Receptacle	#16251-???
18) Dedicated Simplex Receptacle	#16351-???

19) Recessed Clock Receptacle	#5361-CH-?? (Non-Decora)
20) Single Pole Switch	#5621-2-???
21) Double Pole Switch	#5622-2-???
22) Three Way Switch	#5623-2-???
23) Four Way Switch	#5624-2-???
24) Pilot Light Switch "On"	#5628-2-???
25) Pilot Light Switch "Off"	#5631-2-???
26) Projection Screen Switch	#5657-2-???
27) Low Voltage Momentary Switch	#5657-2-???
28) Keyed Switch	#1221-2L-?? (Non-Decora)
29) Door Jam Switch	#1865-???

- b. Use of dedicated receptacles is required where plans depict a branch circuit supplying only a single simplex or duplex receptacle. Use of controlled receptacles is required where depicted on plans - see controlled receptacle specifications for additional information.
2. I.G. (isolated ground) receptacle bodies shall be of a basic color specified above with an orange triangle to symbolize isolated ground.
3. In addition to other device requirements listed elsewhere in this specification and CEC Articles 406.12 & 517.18, all 125V & 250V, 15A and 20A, non-locking receptacles shall be Tamper-Resistant when located in the following locations:
  - a. In preschool and elementary education facilities.
  - b. In business offices, corridors, waiting rooms, and the like in clinics, medical and dental offices and outpatient facilities.
  - c. In a subset of Assembly Areas outlined in CEC Article 518.2 including transportation waiting areas, gymnasiums, skating rinks, and auditoriums.
4. Wiring devices shall be listed "hospital grade", and so identified, in the following locations:
5. Wiring device cover plates located on recessed boxes shall be commercial grade nylon. Plate color shall match wiring device color UON on plans. Cover plates utilized on surface mounted boxes shall be metal. Plastic cover plates are unacceptable.
6. Except as otherwise noted, all wiring device plates on the project shall be labeled with panel and circuit number(s) utilizing a Brother P-Touch labeling system with 1/2" tape (yellow on black) or equal by Herman-Tellerman or Panduit. Locate label on the concealed side of the wiring device plate. Handwritten labels are unacceptable.
7. The Contractor shall provide duplex receptacle outlets in the appropriate configurations necessary to comply with applicable energy code requirements for controlled receptacles and as shown on plans. All wiring devices indicated to be controlled receptacles shall be NEMA-approved, electrical code-compliant with factory markings on the face of the receptacle(s) with the word "Controlled" or utilize further markings and symbols to indicate which receptacles on each outlet

is/are controlled. Stickers, field-applied markings or other non-permanent markings are not acceptable. Where a GFCI receptacle outlet is required to be controlled, provide an adjacent controlled duplex receptacle outlet connected on the load side of the GFCI outlet. Generally, one receptacle in a duplex receptacle outlet is required to be controlled. It may be the lower receptacle or upper receptacle based on manufacturer offering. However, the controlled receptacle location within a controlled receptacle outlet shall remain consistent throughout the project. Where an existing duplex receptacle outlet is required to be controlled, provide a new wiring device with the appropriate control configuration necessary to comply with plans. All controlled receptacles shall be connected to a branch circuit controlled by an occupancy sensor-based or relay panel lighting control system. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell.

8. The following wiring device plates shall have custom engraving:

- a. Key operated switches, switches with pilot lights, and switches for the control of motors, heaters and ventilators. Engraving shall be black and occur on the exposed side of the plate indicating the motor, heater, or ventilator controlled.
- b. All stainless steel and nylon device plates shall be engraved using a rotary engraving process except for black lettering on stainless steel device plates which may be accomplished via laser etching process. All lettering shall be 3/16" high. Provide a dimensioned submittal drawing detailing a typical device faceplate with engraving.

F. Weatherproof Outlet Covers/Assemblies: All Receptacles identified as weatherproof on the drawings shall be weather-resistant, tamper-resistant, GFCI type and equipped as follows:

1. Type WP-A: Recessed wall box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed rain tight while "in use". Unit shall comply with CEC Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation of power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
  - a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
  - b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.
  - c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box. Where shown mounted in a building wall, any blank/unused compartment shall be equipped min. 3/4" C.O. with pull string routed to the nearest accessible ceiling space.
  - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
  - e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
  - f. Custom color powder coat finish as selected by Architect - Include all costs in base bid for same.

- g. In locations with sufficient wall depth, provide 6" wide x 6" tall x 5-1/2" deep recessed wall box (C.W. Cole #TL310-WCS-K1-CUSTOM COLOR).
  - h. In locations utilizing shallow stud walls construction or other walls of insufficient depth, provide 10-3/4" wide x 7-3/8" tall x 3-7/8" deep recessed wall box (C.W. Cole #TL310-WCS-SH-K1 -CUSTOM COLOR).
  - i. See drawings for additional details.
- 2. Type/Subscript WP-B: Wet location-listed raintight while "in use" cast copper-free aluminum, extra-duty, lockable cover with baked aluminum lacquer finish and one gang, weather-resistant, tamper-resistant GFCI receptacle. Hubbell WP26E series. Polycarbonate covers are unacceptable. Unit shall comply with CEC Article 406.9(A) and (B). Contractor shall powder coat cover assembly to a custom color where receptacle locations are deemed by the Architect to be in aesthetically sensitive or public spaces. Custom color as selected by Architect.
- 3. Type WP-C: (C.W. Cole #TL310-WCS-PED-ADA-K1-CUSTOM COLOR or #TL310-WCS-PED-K1-CUSTOM COLOR) pedestal device box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed raintight while "in use". Unit shall comply with CEC Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
  - a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
  - b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.
  - c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box.
  - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
  - e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
  - f. Include all costs in base bid for ADA version (22.5" tall) of pedestal box. Prior to ordering material, contractor shall coordinate with Architect and/or AHJ to determine which pedestal box locations do not require ADA compliance and may be changed to the standard (11.5" tall) version of the pedestal box.
  - g. Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.
  - h. See drawings for additional details.
- 4. Type/Subscript WP-D: Damp location-listed (not-Raintite-in-use) cast copper-free, pad lockable, die-cast aluminum cover with baked aluminum lacquer finish and one gang GFCI receptacle. Hubbell/Rayco 502?/503? Series. Polycarbonate covers are unacceptable. Unit shall comply with CEC article 406.9(A) and (B). Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.

**G. Circuit Breakers:**

1. Service entrance circuit breakers smaller than 400A (Amp) frame shall be thermal-magnetic trip with inverse time current characteristics unless otherwise indicated below. Service entrance main circuit breakers and main circuit breakers, 400A frame and larger, shall be 100% rated, solid-state type as outlined in this specification. All other service entrance circuit breakers, 400A frame and larger, shall be 100% rated, solid-state type as outlined in this specification.
2. All non-service entrance circuit breakers 225A and larger shall be thermal magnetic type and have continuously adjustable instantaneous pick-ups of approximately 5 to 10 times trip rating. Breakers shall have either tamper-resistant rating dials or easily changed trip rating plugs with trip ratings as indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Additionally, all non-service entrance circuit breakers, 600A frame and larger, located in 480V, 3-phase, 3-wire or 277/480V, 3-phase, 4-wire switchgear, distribution boards, panel boards or busway plugs shall be solid state, 100% rated. Breaker shall have built-in test points for testing long delay, short delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above - at the Engineer's request.
3. All non-service entrance circuit breakers less than 225A shall be molded plastic case, air circuit breakers conforming to UL 489. Provide breakers with thermal magnetic trip units, and a common trip bar for two- or three-pole breakers, connected internally to each pole so tripping of one pole will automatically trip all poles of each breaker. Provide breakers of trip-free and trip-indicating bolt-on type, with quick-make, quick-break contacts. Provide single two- or three-pole breaker interchangeability. Provide padlocking device for circuit breakers as shown on the Drawings.
4. Where a Current Limiting Circuit Breaker (CLCB) is indicated on drawings or as required elsewhere in this specification, provide a UL listed current limiting thermal magnetic circuit breaker(s) UON. An independently operating limiter section within a molded case is not allowed. Coordinate CLCB ratings as required to protect electrical system components on the load side of the CLCB to include, but not limited to, protecting automatic transfer switches, panel boards and lighting control panels.
5. Where a solid-state circuit breaker is indicated on drawings or as required elsewhere in this specification, provide a solid-state circuit breaker with minimum five function complete with built-in current transformers. The five functions shall be independently adjustable and consist of Overload/Long Time Amp Rating, Long Time Delay, Short Time Delay, Short Circuit/Instantaneous Pickup, but may also include Shunt Trip and/or Ground Fault if so indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above, at the Engineer's request.

6. Circuit breakers, 1200A Frame or larger, or circuit breakers with sensors or adjustable trip settings, 1200A or larger, shall be equipped with an Energy Reducing Maintenance Switch that complies with CEC 240.87 (B) (3) unless specified elsewhere with an alternate arc energy reduction method allowed by this same code section.
7. Tandem or half-sized circuit breakers are not permitted.
8. Series-Rated Breakers: UL listed series-rated combinations of breakers can be used to obtain panelboard-interrupting ratings shown on Drawings. If series-rated breakers are used, switchboards, distribution boards, and panel boards shall be appropriately labeled to indicate the use of series-rated breakers. Shop drawing submittal shall include chart of UL listed devices, which coordinate to provide series rating.
9. Circuit breakers shall be standard interrupting construction. Panelboard shall accept standard circuit breakers up to 100A.
10. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.
11. Shunt-trip equipped circuit breakers shall be provided on all elevator feeders.
12. Temperature compensating circuit breaker(s) shall be provided when located in outdoor enclosure(s) or when located in an enclosure subject to high ambient heat due to due nearby industrial processes, etc.
13. Provide 75 degree Celsius-rated conductor lugs/lug kits as required on all circuit breakers to accept conductor quantities and sizes shown on drawings.
14. All circuit breaker terminations shall be suitable for use with 75-degree Celsius ampacity conductors. Listed, dual-rated pin terminals, straight or offset, are acceptable for use to in accommodating oversized or parallel conductor installations.
15. Circuit breakers serving Fire Alarm or Central Monitoring panels and power supplies shall be red in color and lockable in the "ON" position.

**H. Disconnect Switches:**

1. Non-fusible or fusible, heavy-duty, externally-operated horsepower-rated, 600V A.C: Provide NEMA 3R, lockable enclosures for all switches located on rooftops, in wet or damp areas and in any area exposed to the elements.
2. Fusible switches shall be Class "R" when 600A or less or Class "L" when greater than 600A.
3. Amperage, Horsepower, Voltage and number of poles per drawings: All shall be clearly marked on the switch nameplate.
4. Provide the Owner's project manager with one (1) spare set of fuses and two (2) sets of fuse clips/fuses for every set of fuses on the project.

5. Motor Protection:

- a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
- b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
- c. Where fuses feeding motors are indicated, but not sized, it shall be the responsibility of the Contractor to coordinate the fuse size with the motor to provide proper motor running protection.
- d. When rejection type fuses are specified (Class RK series) the fuse holder of all switches (specified in other Sections) shall be suitable for the fuses provided.

I. Lighting Control/Dimming Systems:

1. See drawings for Lighting Control and/or Dimming Systems schedules and specifications.

J. Fire Alarm System/Central Monitoring System:

1. See drawings for Fire Alarm System - Voice specifications.

K. Conduit:

1. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metalizing, or sherardizing process.
2. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242, and meet Federal Specification WWC-581 (latest revision).
3. Electrical Metallic Tubing (EMT) shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces. EMT shall be dipped in a chromic acid bath to chemically form a corrosion-resistant protective coating of zinc chromate over galvanized surface.
4. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Use only as directed in writing by the Engineer with the exception of 400 Hz feeders and 400 Hz branch circuits which shall be run in flexible aluminum conduit.
5. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory-installed fittings. For outdoor installations and motor connections only unless otherwise noted on drawings.
6. Factory assembled, or off-site assembled wiring systems (such as Metal Clad (MC) Cable, Type AC Cable, Type NM Cable, Type BX Cable, etc.) shall not be

used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing.

7. Nonmetallic Flexible Tubing (ENT) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing. Use of ENT, if allowed, is strictly limited to use in CMU walls and parking structures decks or as directed in writing by the Engineer. See PART 3 - EXECUTION section in this specification for additional installation requirements.
8. Non-Metallic Conduit:
  - a. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to Underwriters Laboratories, Inc. (UL) requirements, listed for exposed and direct burial application.
  - b. Conduit and fittings shall be produced by the same manufacturer.

**L. Fittings:**

1. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system. These fittings shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.
2. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.
3. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.
4. UON all EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trades sizes of 2" and smaller. Insulated throat is not required for fittings, connectors and couplings 1" and smaller.
5. All interior and exterior EMT fittings, connectors and couplings, 2" and smaller, installed in exposed or concealed locations that are considered by the AHJ to be wet or damp locations, shall be Raintite-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If Raintite-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage – provide rigid metallic or intermediate metallic conduits, fittings, connectors and couplings as required.

6. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.
7. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

**M. 600 Volt Conductors - Wire and Cable:**

1. All conductors shall be copper. Provide stranded conductor for #10 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.
2. Type THHN/THWN-2 thermoplastic, 600 volt, UL approved, dry and wet locations rated at 90 degrees Celsius, for conductors of all sizes from #12 AWG up to and including 1000 kcmil. RHH/RHW insulation is allowed only to provide an Electrical Circuit Protective System to comply with CEC Articles 695 and 700.
3. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.
4. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.
5. Systems Conductor Color Coding:
  - a. Power 208/120V, 3PH, 4W:
    - 1) Phase A = Black
    - 2) Phase B = Red
    - 3) Phase C = Blue
    - 4) Neutral = White or White with Phase Color Tracer
    - 5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
    - 6) Travelers = Purple with Black stripe or Pink.
  - b. Power 480/277V, 3PH, 4W:
    - 1) Phase A = Brown
    - 2) Phase B = Orange
    - 3) Phase C = Yellow
    - 4) Neutral = Grey or Grey with Phase Color Tracer
    - 5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
    - 6) Travelers = Purple with black stripe or Pink..
  - c. Ground Conductors: Green
  - d. Isolated Ground Conductors: Green with continuous yellow stripe.
  - e. Fire Alarm System: As recommended by the manufacturer.

6. All color-coding for #12 through #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified with utilizing phase tape at each termination.
7. No conductors carrying 120V or more shall be smaller than #12 AWG.
8. Aluminum conductors shall not be used.
9. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles and block and tackle to install conductors are not acceptable.

**N. Junction and Pullboxes:**

1. For interior dry locations, boxes shall be NEMA 1 galvanized one-piece drawn steel, knockout type, with removable, machine screw secured covers.
2. For outside, damp or surface locations, boxes shall be NEMA 3R heavy cast aluminum or cast iron with removable, gasketed, non-ferrous machine screw secured covers.
3. For in-grade applications, junction and pull boxes shall be pre-cast concrete or molded fiberglass manufactured by Christy, Brooks-Jensen, or Utility Vault Co. Fiberglass boxes shall:
  - a. Be used only in landscape planter areas that are not subject to damage from lawnmowers, tractors and other machinery.
  - b. Not be used in lawn or turf areas.
  - c. Not exceed 11" W x 17" L in size unless required to be larger to meet code requirements.
4. All boxes shall be sized for the number and sizes of conductors and conduits entering the box and equipped with plaster rings where required.
5. All boxes located in traffic areas shall be traffic rated.

**O. Outlet Boxes:**

1. For fixtures, boxes shall be galvanized, one-piece drawn steel, knockout type equipped with 3/8" fixture studs and plaster rings where required.
2. For convenience outlets, wall switches, or other devices, outlet boxes shall be galvanized one-piece drawn steel, knockout type 4" x 4" x 2-1/8" minimum size with plaster rings as required.
3. For locations where standard boxes are not suitable due to number and size of conduit to be terminated, special boxes shall be designed to fit space or meet other requirements, and submitted for approval.

4. For exposure to weather, damp locations, or surface mounting, outlet boxes shall be heavy cast aluminum or cast iron with threaded hubs; covers shall be watertight with gaskets and non-ferrous screws.
  5. Outlet boxes used for support of ceiling fans shall be galvanized, one-piece drawn steel, knockout type equipped with bracing bars and plaster rings where required and listed for ceiling fan support use. Such boxes shall be labeled and capable of supporting ceiling fan weights up to 70 pounds.
  6. See drawings for floor box installation notes and specifications.
- P. Plywood Backboards: Where indicated for telephone or communications system terminals or other equipment assemblies, provide backboards of size indicated. Use 3/4" thick x 8' all (length per plans), Douglas Fir, void-free, kiln-dried, fire-rated plywood finished on one side and prime coat painted on all surfaces with finish coat of enamel paint, color by Architect. Leave one (1) fire-rating stamp/sheet exposed for inspection.
- Q. Terminal Cabinets:
1. Terminal cabinets shall be fabricated of hot dipped galvanized code gauge sheet metal for flush or surface mounting, complete with barriered sections, a door for each vertically barriered section and sizes as indicated on plan. Doors shall be hinged and lockable. Locks shall be keyed to match the branch circuit panelboards. Terminal cabinet trims shall match the branch circuit panels.
  2. Provide each terminal cabinet with a full size mounting backplate.
  3. Terminal cabinets shall be installed complete with full-length skirts of the same construction and finish as the terminal cabinet.
  4. Where mounted outdoors, terminal cabinets shall be NEMA 3R, weatherproof complete with gaskets and required sealant to prevent moisture from entering the terminal cabinet.
  5. All terminal cabinets and terminal cabinet barriered sections shall be labeled by the cabinet or cabinet section use (i.e. CATV, Security, etc.). Labels shall be Micarta type as specified elsewhere in these specifications. Unless otherwise noted, all termination blocks and cables shall be labeled per ANSI/EIA 606 standard.
- R. Painting: Terminal cabinets, panels, junction boxes, pull boxes, etc., and conduit installed in public view shall be painted with colors selected by the Architect to match the subject surfaces. Refer to painting section of the specifications for additional requirements.
- S. Seismic Design, Certification and Anchoring of Electrical Equipment:
1. Contractor shall include all costs in the base bid for labor, materials, all special inspections and structural engineering design necessary to meet the Seismic Design Requirements for Non-structural Components (Chapter 13, ACE SEI 7-05 Minimum Design loads for Buildings and Other Structures) as required by CBC

Section 1708 and as related to the installation all electrical equipment furnished under this contract. See Specific Project Site Seismic Criteria on architectural and/or structural plans which include Building Occupancy Category, Seismic Design Category, Design Spectral Response Acceleration ( $S_{DS}$ ), Height factor ratio ( $z/h$ ) and Site Class. Non-structural Component Importance Factor ( $I_P$ ) for a particular component shall be determined based on the following criteria:

- a.  $I_P = 1.0$ : Non-life safety, Non-structural Components in an Occupancy Category IV Facility not required for continued operations of the facility or in any other Occupancy Category Facility where component failure will not impair continued operation of the facility.
  - b.  $I_P=1.5$ : Designated Seismic Systems are those non-structural components in any Occupancy Category IV facility (except as noted above) or that are a part of any code-defined Critical, Life Safety, Emergency and Legally Required Standby Electrical System. Additionally, those non-structural components containing hazardous materials shall be classified as Designated Seismic Systems. While Designated Seismic Systems are generally identified on the plans, they may include items such as generators, automatic transfer switches, UPS units and all associated electrical distribution equipment and components necessary for the designated seismic system to form a complete and operable system. The Contractor shall ultimately be responsible for identifying Designated Seismic Systems. For any electrical component either identified on the plans or determined by the contractor to be a Designated Seismic System, all line and load side electrical distribution systems supporting that Designated Seismic System (including, but not limited to, feeders, panel boards switchboards, transformers, all related component supports and attachments etc.) shall be considered a part of the designated seismic system for the purposes of code-compliance and seismic certification.
  - c.  $z/h$  - Height factor ratio: See plans for respective equipment locations.
2. Provide a delegated-design submittal for each of the following seismic-restraint systems to be used as required:
- a. Restraint Channel Bracings consisting of MFMA-4, shop-or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.
  - b. Restraint Cables consisting of ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service, with a minimum of two clamping bolts for cable engagement.
  - c. Seismic-Restraint Accessories consisting of hanger rod/hanger rod stiffener assemblies, multifunctional steel connectors for attaching hangers to rigid channel bracings and/or restraint cables, bushings for floor and wall-mounted equipment anchor bolts and resilient isolation washers and bushings.
  - d. Mechanical Anchor Bolts consisting of drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

- e. Adhesive Anchor Bolts consisting of drilled-in and capsule anchor system containing resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide specific LEED-compatible environmentally-friendly resins and adhesives on all LEED projects. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
3. Submittal shall include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the contractor's structural engineer responsible for their preparation. Calculations shall include, but not be limited to, static and dynamic loading caused by equipment weight, operation, and seismic and, if applicable, wind forces required to select seismic and, if applicable, wind restraints and for designing vibration isolation bases. Provide seismic and wind-restraint detailing to support system selection, arrangement of restraints, attachment locations, methods, and spacings with all components identified to include their strengths, directions and values of forces transmitted to the structure during seismic events and association with vibration isolation devices. Sizes of components shall be selected so strength will be adequate to carry present static and seismic loads to accommodate 25% spare future capacity within specified loading limits.
4. Any pre-approval and evaluation documentation shall have a California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproval (OSP) demonstrating horizontal and vertical load testing and analysis showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
5. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified elsewhere in the project specifications.
6. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment. Flexible connection limitations of the CEC shall apply.
7. Install seismic-restraint devices using methods approved by OSHPD or an agency acceptable to authorities having jurisdiction providing required submittals for component.
8. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by OSHPD or an agency acceptable to authorities having jurisdiction.

9. The contractor shall engage a qualified testing agency to perform tests and inspections as listed in other Project Specifications, but as a minimum shall include at least four of each type and size of installed anchors and fasteners selected by Architect. Schedule tests with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members as required. Test to 90 percent of rated proof load of device. Prepare and submit test and inspections reports.
- T. Trenching and Backfilling: Contractor shall be responsible for trenching and backfilling. Refer to Trenching and Backfilling section of the specifications for complete requirements.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION AND INSTALLATION**

- A. Installation of Conduit and Outlet Boxes:
  1. All conduit installed in the dry walls or ceilings of a building shall be steel tube (EMT), aluminum tube (EMT), or Intermediate Metal Conduit (IMC). Flexible conduit shall not be used in lieu of EMT, IMC or rigid conduit except as noted herein.
  2. Galvanized rigid conduit (GRC) or intermediate metal conduit (IMC) shall be used as follows:
    - a. When noted on the drawings.
    - b. When considered exposed to damage by the local AHJ.
    - c. When installed in wet or damp locations and of a trade size where listed-Raintite fittings, connectors, couplings etc. are unavailable.
    - d. When required by CEC Article 517.13.
    - e. When installed in concrete and masonry. The use of ENT in CMU walls and parking structures may be allowed only as directed in writing by the Engineer. Request for ENT substitution must be made prior to bid and in accordance with pre-bid substitution requests requirements of these specifications.
  3. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or steel-tube EMT and in accordance with CEC Article 342.
  4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. Except when concealed in walls or other structural elements, all flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Include a separate insulated green ground conductor sized per CEC in each conduit. Other uses of flexible conduit shall be allowed only as approved in writing by the Engineer.
  5. Flexible liquidtight conduit shall be installed in lieu of the flexible steel; where required by the CEC in damp and wet location, where exposed to weather, in

refrigerated area (65°F or less), and/or between seismic joints. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches. Include a separate insulated green ground conductor sized per CEC in each conduit. Other uses of liquidtight flexible conduit shall be allowed as approved in writing by the Engineer on a case by case basis.

6. Rigid metallic conduit installed underground or embedded in concrete shall be 1" trade size minimum and shall be wrapped with 20 mil. Polyvinylchloride plastic tape, PVC conduit installed underground or embedded in concrete shall be 3/4" minimum trade size.
7. Where required for providing an electrical circuit protective system to comply with CEC Articles 695 and 700 utilize UL Listed 2-hour fire-rated, MC cable or UL Listed 2-hour fire-rated RHH/RHW conductors in conduit.
8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.
9. The ends of all conduit shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.
10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.
11. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight.
12. All metal conduit in masonry and concrete and where concealed under floor slabs shall have joints painted with thread compound prior to makeup.
13. PVC conduit shall not be run in walls except where approved by the Engineer prior to bid in limited instances that may include concrete or CMU walls used in site retaining, parking structures, or exterior equipment yard or enclosure walls, etc.
14. Where conductors enter a raceway or a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.
15. Where conduit extends through roof to equipment on roof area, the Contractor shall provide flashing material compatible with the roofing system as required by the roofing specifications or as required by the Owner's roof warranty. This flashing shall be delivered to the roofing Contractor for installation. The actual location of all such roof penetrations and outlets shall be verified by the Architect/Owner. Contractor to verify type of flashing prior to bid and include all costs.
16. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two-hole conduit clamp properly secured.

17. Where conduit racks are used the rack shall consist of two-piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.
18. Nail-in conduit supports, one-piece set screw type conduit clamps or perforated iron for supporting conduit shall not be used.

19. Seismic Conduit Support:

- a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

<u>CONDUIT SIZE</u>	<u>MAXIMUM SPACING</u>
1/2" to 3"	6'-0"
3-1/2" to 4"	8'-0"

20. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.
21. Open knockouts in outlet boxes only where required for inserting conduit.
22. Locate wall outlet of the same type at same level in all rooms, except where otherwise noted.
23. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or screwed to studs; on wood studs attachment shall be with wood screws, nails are not acceptable.
24. Recessed boxes shall not be mounted back-to-back in any wall; minimum offset shall be 24 inches.
25. Junction Boxes that do not contain any device(s) shall be located in storage rooms, electrical closets, or above accessible ceilings, not in hard lid ceilings or other forms of inaccessible ceilings. Place boxes which must be exposed to public view in a location approved by the Owner's Project Manager. Provide covers or plates to match adjacent surfaces as approved by the Owner's Project manager.
26. Surface mounted pull boxes, terminal cabinets, junction boxes, panel boards etc., shall be attached to walls using appropriate screws, fasteners, backing plates, stud blocking etc., as detailed on architectural and/or structural drawings. If architectural and/or structural drawings are not provided on the project, Contractor shall provide all necessary mounting hardware and backing support to comply with local building code requirements and any additional requirements imposed by the local Authority-Having-Jurisdiction.
27. Sleeves shall be installed where conduit passes through masonry or concrete walls and shall be 24-gauge galvanized steel no more than 1/2" greater in

diameter than the outside diameter of the conduit. When located in non-rated structures, caulk conduit sleeve with stone wool and waterproof below grade. When located in fire rated structures, provide UL listed fire stopping system. See fire stopping section of this specification for additional requirements.

28. All boxes shall be covered with outlet box protector, Appleton SB-CK, or similar device/method to keep dirt/debris from entering box, conduit or panels. If dirt/debris does get in, it shall be removed prior to pulling wires.
29. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover, and painted as directed by the Architect with weatherproof paint to match building.
30. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.
31. Provide nylon or a 1/8-inch O.D. polyethylene rope, rated at 250 pounds tensile strength, in all conduits more than 5 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the conduit. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the conduit.
32. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/racks, Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system. Support conduit to structure above suspended ceilings 8" minimum above ceiling to allow removal of ceiling tile. Maintain two-inch clearance above recessed light fixtures
33. All exposed conduits and support hardware shall be painted to match the finish of the wall or ceiling to which it is supported.
34. Where conduits or wireways cross seismic joints, provide approved flexible conduit connection or approved expansion/deflection fitting to allow for displacement of conduit in all three axes. Connection shall allow for movement in accordance with design of seismic joint. Non-flexible raceways crossing expansion joints or other areas of possible structural movement shall make provision for 3-way movement at such points by means of expansion/deflection fittings. Fittings shall be installed in the center of their axes of movement and shall not be deflected to make part of a conduit bend, or compressed or extended to compensate for incorrect conduit expansion/deflection fittings(s) complete with ground jumpers. Where necessary, provide approved expansion joints to allow for thermal expansion and contraction of conduit(s). Install expansion joints complete with ground jumpers.
35. Seal all conduits where termination is subject to moisture or where conduit penetrates exterior wall, floor or roof, in refrigerated areas, classified (hazardous areas) and as indicated on the drawings.
36. Except as otherwise indicated on the Drawings or elsewhere in these specifications, bends in feeder and branch circuit conduit 2 inches or larger shall have a radius or curvature of the inner edge, equal to not less than ten (10) times

the internal diameter of the conduit. Except where sweeping vertically into a building, and where sweep radius equals ten (10) times conduit diameter, underground communications and building interconnect conduits 3 inches or larger shall have a minimum 12'-6" radius or curvature of the inner edge. For the serving utilities, radius bends shall be made per their respective specifications.

37. Tag all empty conduits at each accessible end with a permanent tag identifying the purpose of the conduit, footage end-to-end, and the location of the other end. In wet, corrosive outdoor or underground locations, use brass, bronze, or copper 16-gauge tags secured to conduit ends with #16 or larger galvanized wire. Inscribe on the tags, with steel punch dies, clear and complete identifying information.
38. The following additional requirements shall apply to underground conduits:
  - a. Underground conduit shall be Schedule 40 PVC (polyvinyl chloride) unless otherwise indicated elsewhere in these specifications or as required per CEC Article 517.13.
  - b. For all communications conduits 2" and larger and feeders 100A or greater, provide with a minimum 3" inch, (2,000 LB) concrete envelope, 2-inch minimum separation between conduits, installed at depth of not less than 24" below grade. (Provide concrete encasement and/or greater minimum conduit depth as required by the Utility Companies.) Conduit separation within a duct bank shall be maintained using plastic spacers located at 5'-0" intervals. Where power and communication conduits are run in a common trench, a 12-inch minimum separation shall be maintained between power and communication conduits or as required by Utility Companies. Where concrete encasement is not required by serving utilities for a utility-only duct bank, provide free draining sand bedding suitable to achieve 95% relative compaction based on ASTM D1557 using 6" lifts or directed by Utility Company Standards.
  - c. In all cases, where any conduit(s) pass under a building slab or footing, the electrical Contractor will provide a Bentonite clay or concrete barrier that conforms to the height and width of the trench excavation extending a minimum of 24" on either side of the foundation. In all cases, where conduit(s) pass through a sleeve in a footing or other foundation element, the electrical Contractor will provide a Bentonite clay or concrete barrier between the sleeve and the conduit(s) surrounding the conduit(s) for the entire depth of the sleeve. The barrier is required to prevent passage of moisture under or through the slab or footing via the trench or sleeve.
  - d. Where underground conduit passes under a building slab, concrete encasement may not be required, except as required above, contact the Engineer for written direction prior to omitting any encasement.
  - e. Underground conduits, which terminate inside building(s) below grade, such as in a basement level, or which slope so that water might flow into interior building spaces, shall be sealed at the point of penetration with a modular conduit seal (Link-Seal or equal by Rox Systems). Conduit/conduit sealing system penetrations of waterproofing membranes/systems on existing structures shall be completely restored as required to maintain membrane/system manufacturer and installer warranty for the installation. All conduits shall be provided with a 4% slope away from buildings. All conduits shall be installed such that the water cannot accumulate in the conduit and

such that water drains into the nearest manhole, pull box or vault – not into the facility. In instances where grade changes or elevation differences prevent sloping of conduit away from a building into the nearest manhole, pull box or vault or where accumulation of water in a manhole, pull box or vault may result in water traveling into the facility, conduits shall be sealed internally at each end of each conduit using conduit sealing bushing, sized as required for the conductors contained within the conduit (O-Z Gedney #CSBG 100psig withstand or equal). In all cases, install plugs or caps in spare (empty) conduits at both ends of each conduit (Jackmoon or equal) preventing both water and gas from entering the facility via the conduits.

- f. Include a separate insulated green ground conductor sized per CEC where in each underground electrical feeder/branch circuit.
  - g. All underground conduits with circuits rated at 40As or greater and all underground communications conduits shall be provided with a metallic marker tape located 12 inches below the finished grade.
  - h. Where underground conduits sweep into/through slabs, utilize PVC 90 degree sweeps that transition, via female PVC adapter to GRC coupling mounted flush in slab. GRC couplings shall be 1/2 lap taped with 20-mil tape. If the distance of the conduit run between a sweep and the next connecting sweep, pullbox, vault or manhole exceeds 150 ft then the sweep shall be concrete encased. Exceptions:
    - 1) Communications conduits shown terminating at a finished floor shall have an additional 4" high GRC nipple equipped with a bushing, removable conduit plug, labeling tag and pull rope. Tie off pull rope to conduit plug.
    - 2) Utility conduit sweeps shall be installed per the requirements of the respective utility company.
  - i. All PVC conduit shall be glued for a water and gas tight installation. The Contractor shall use appropriate solvent on all joints prior to gluing conduit and fittings together.
  - j. All underground conduit work shall conform to the Federal, State and Local Safety Orders or Rules regarding excavations, trenches and related earthwork. For projects in California, refer to the California Code of Regulations, Title 8, Construction Code Sections 1540 and 1541 for additional requirements.
39. Installation of Electrical Nonmetallic Tubing (ENT) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing).
- a. When approved for use in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing, 1/2" and 3/4" trade size ENT shall be allowed for concealed lighting branch circuits, receptacle branch circuits and miscellaneous signal system circuits within concrete floors, walls and columns within parking structures.
  - b. ENT conduit shall meet the requirements of Underwriters Laboratories Standards 1479 and 1655, NEMA TC-13, and be UL-listed.
  - c. All ENT conduit, ENT fittings, ENT boxes and ENT accessories shall be UL listed and manufactured by the same manufacturer so as to form a complete ENT system. ENT systems shall only be used if they are listed for use in fire

resistance rated concrete floors and ceilings with resistance ratings as indicated elsewhere in the project plans. ENT system shall comply with CEC Article 362.

- d. All ENT fittings and ENT boxes shall be concrete-tight listed without the use of tape. Additionally, ENT fittings shall be constructed of high impact PVC and able to resist ENT conduit pull out forces of a minimum of 175 lbs. ENT fittings with fewer than 6 locking tabs for ENT connection shall utilize manufacturer approved glue as additional protection from fitting/conduit separation. ENT conduit to rigid conduit transition fittings shall be equipped with set screw fittings on the rigid conduit side of the fitting. ENT to metal box fittings shall be equipped with a threaded end and lock washer.
- e. Where tubing enters a box, fitting, or other enclosure provide a bushing or adapter to protect conductors from abrasion unless the box, fitting, or enclosure design provides equivalent protection.
- f. ENT junction boxes shall have brass screw inserts and shall be rated to support lighting fixtures weighing less than 50 lbs.
- g. Concrete tight metal boxes shall be used to support pendant hung fixtures or fixtures over 50 lbs.
- h. ENT shall be provided in continuous lengths between junction boxes without use of in-line splices or connectors and shall be clearly marked/labeled at least every 10 feet.
- i. All ENT conduit containing electrical branch circuits shall contain a code-sized equipment ground conductor.
- j. ENT shall transition to EMT, IMC, RMC, or rigid PVC, as appropriate or as called out elsewhere in this specification, for all exposed conduits within/on/under a parking structure.
- k. ENT shall transition to appropriately sized PVC expansion joint(s) at all structure expansion or seismic joints.
- l. ENT shall be securely fastened and supported every 2 – 3 ft. and within 1 ft. of every junction box and fitting to prevent movement and sag.
- m. ENT shall be routed straight without sags, or excessive bending. Where bends are required, comply with Table 362.24 of the CEC for minimum radius of bends. Number of bends shall not exceed quantity allowed by code where used for power and lighting branch circuit and/or feeder conductors. Where utilized for communications system conductors (phones, data cabling, etc.) number of bends shall not exceed the equivalent of (2) 90-degree bends with conduit length no more than 100 feet without installation of a TIA 569-compliant pull box.
- n. Separation of ENT from fittings, excessive sags, or deflections in ENT runs that prevent pulling of wire and other ENT system product or system installation failures/errors shall be corrected by saw cutting and patching as necessary at no additional cost to the Owner. Use of surface mounted conduits and junction boxes as a repair method is unacceptable.
- o. Empty ENT runs shall be provided with a nylon pull string.
- p. Coordinate installation of raceway with structural steel and other structural members. Do not cut, notch or otherwise alter structural members without obtaining approval in writing from the Structural Engineer of record.
- q. No more than (2) 3/4" ENT conduits may cross each other within a horizontal concrete slab without obtaining approval in writing from the Structural Engineer of record.

**B. Installation of 600-Volt Conductors:**

1. All electrical wire, including signal circuits, shall be installed in conduit.
2. All circuits and feeder wires for all systems shall be continuous from over current protective device or switch to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.
  - a. Utilize preinsulated "winged" spring type connectors, 3M Company "Performance Plus" #O/B or #R/Y or equal as required for splices and taps in conductors #6 AWG and smaller. When a spring connector is used in an underground environment or when subject to moisture, utilize a 3M Company Scotchcast 3507G epoxy resin connector sealing pack to seal the spring connector. **THE USE OF PUSH-WIRE CONNECTORS (e.g. "WAGO" OR EQUIVALENT) IS STRICTLY PROHIBITED.**
  - b. Wires #4 AWG and larger AWG shall be joined together as follows:
    - 1) When located in an underground environment or when subject to moisture, the splice shall be made with compression connector and sealed by a 3M, or equal, PST cold shrink connector insulator.
    - 2) When located in an interior environment, the splice shall be made with an IlSCO or equal dual rated, insulated splice-reducer connector or multi-tap connector-listed for use with 75/90-degree Celsius rated conductors.
  - c. Connections to busbar shall be made with dual-rated copper/aluminum one-piece compression lugs. Paralleled conductor connections shall be by mechanical lugs.
3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires.
4. Install UL approved fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.
5. For 20A branch circuit wiring, increase #12 conductors to #10 for 120-volt circuits longer than 100 feet and for 277V circuits longer than 150 feet.
6. Conductor Support: Provide conductor supports as required by codes and recommended by cable manufacturer. Where required, provide cable supports in vertical conduits and provide lower end of conduit with a ventilator.

**C. Grounding/Bonding:**

1. Provide grounding and bonding for entire electric installation as shown on plans, as listed herein, and as required by applicable codes. Included, but not limited to, are items that require grounding/bonding:
  - a. Conduit, Raceways and Cable Trays.
  - b. Neutral or identified conductors of interior wiring system.
  - c. Panel boards, Distribution Boards, Switchgear and Switchboards.
  - d. Non-current carrying metal parts of fixed equipment.
  - e. Telephone distribution equipment.
  - f. Metal piping installed in or attached to a building/structure.

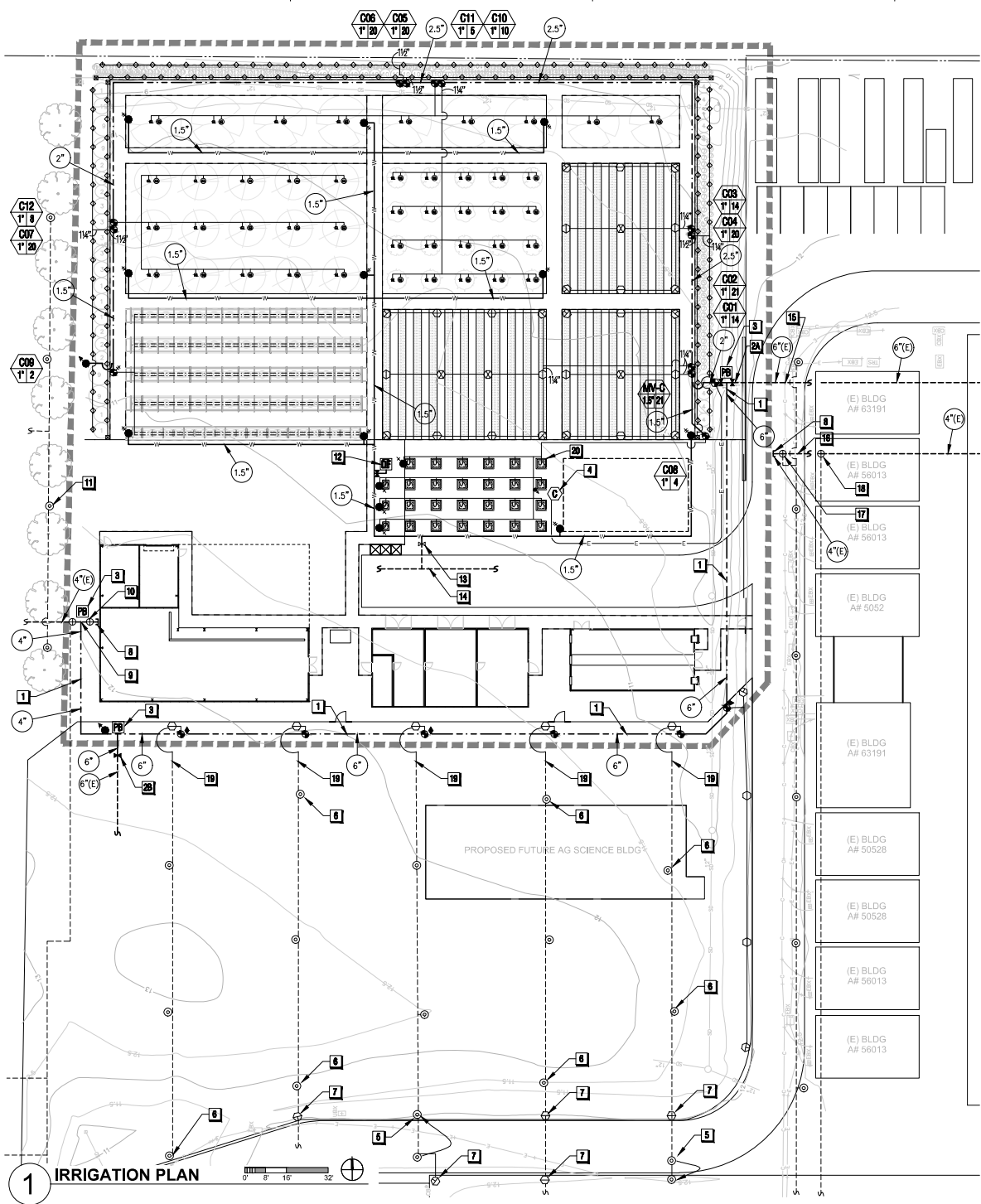
2. In multi-occupancy buildings, Contractor shall bond metal water piping systems installed in, under or attached to a building and/or structure serving individual occupancies where the piping system(s) are metallically isolated from each other. Per CEC ART. 250.104(A)(2) and (4), the bonding conductor shall be sized per Table 250.122 and connected to the switchboard/panel board serving that suite/occupancy.
3. Use of Ground Rods: Furnish and install required number of 3/4" x 10' copper clad ground rods to meet specified resistance, all required grounding wires, conduit and clamps. The size of the grounding conductors shall be not less than that set forth in the latest edition of the California Code of Regulations, Title 24, State of California and CEC unless otherwise indicated. Rods shall be installed such that at least 10 feet of length is in contact with the soil. Where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or shall be buried in a trench that is at least 30 inches deep. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding electrode conductor attachments are protected against physical damage. Unless otherwise noted, connection to the grounding electrode conductor may be by compression type or exothermic process connector. Mechanical connectors shall not be used.
4. Grounding System Connection:
  - a. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.
  - b. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended connection.
  - c. Mechanical connectors shall not be used.
5. Isolated Ground Receptacles shall have an insulated ground wire connected between the receptacle and the panelboard isolated ground bus. Unless otherwise noted, this ground wire shall not be grounded at any other point, and shall be distinguished from other ground wires by a continuous yellow stripe.
6. Provide separate green equipment ground conductor in all electrical raceways to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through #10 AWG. Use CEC Table 250.122 for conductor size with phase conductors #8 and larger, if not shown on the Drawings.
7. Clean the contact surfaces of all ground connections prior to making connections.
8. Ductwork: Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.

9. Motors: Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium plated steel.
  10. Building grounding system resistance to ground shall not exceed 25 ohms unless otherwise noted and should be confirmed by testing.
- D. Line Voltage and Low Voltage Power Supplies to all Mechanical Equipment Including Plumbing, Heating and Air Conditioning Units:
1. An electric power supply, including conduit, any necessary junction and/or outlet boxes and conductors and connection shall be furnished and installed by the Contractor for each item or mechanical equipment.
  2. Power supplies to individual items of equipment shall be terminated in a suitable outlet or junction box adjacent to the respective item of equipment, or a junction box provided by the manufacturer or the equipment and directed by the Mechanical Contractor. Allow sufficient lengths of conductor at each location to permit connection to the individual equipment without breaking the wire run.
  3. The location of all conduit terminations to the equipment is approximate. The exact location of these conduit terminations shall be located and installed as directed by the Mechanical and Plumbing Contractor.
  4. Provide power supplies to all plumbing and mechanical equipment, including but not limited to, equipment furnished and installed by Owner or Contractor such as heating and air conditioning equipment, pumps, boilers, auto valves, water coolers, trap primers etc. The installation shall produce a complete and operable system.
  5. Unless otherwise noted, the Contractor shall furnish and install all conduit, boxes, wires, etc., for line voltage wiring and low voltage wiring.
  6. It is the Contractor's responsibility to verify with the drawings of other trades regarding the extent of his responsibility for mechanical equipment. The bid must include a sum sufficient to cover the cost of the installation.
  7. The location of all power supply connection and/or terminations to the mechanical equipment is approximate. The exact locations of these terminations shall be verified with other trades during construction.
- E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.
- F. Firestopping:
1. The Contractor shall be responsible for furnishing all material, labor, equipment, and services in conjunction with the selection and installation of a complete, fully

functioning, code compliant, UL-listed, fire stop assembly/system(s) as required by project conditions.

2. Each fire stop assembly/system shall have an "F" and/or "T" rating as required by each condition requiring fire stopping. Each fire stop assembly/system shall have a current UL listing, as indicated in the latest edition of the UL Fire Resistance Directory. Contractor shall verify acceptability of all fire stopping methods and system selections with the authority having jurisdiction prior to installation. The Contractor shall install each fire stop assembly/system in accordance with the manufacturer's printed instructions.
3. Each fire stop assembly/system shall be labeled with fire stop manufacturer-furnished label on each side of the fire stopping systems depicting UL # etc.

**END OF SECTION**



**SHEET NOTES**

GENERAL NOTE: THE DRAWING IS DIAGNOSTIC AND LOCATION OF EXISTING IRRIGATION EQUIPMENT HAS NOT BEEN FIELD MEASURED. LOCATE ACTUAL EXISTING PIPE, VALVE, AND HEAD LOCATIONS IN THE FIELD PRIOR TO CONSTRUCTION. CONFIRM IN THE FIELD THAT AFTER CONSTRUCTION ALL (E) HEADS OUTSIDE OF THE CONTRACT WORK AREA REMAIN 6"-8" AND ARE CONNECTED TO AN RCV TO CONTROL THE HEADS. MAKE CONSTRUCTION CORRECTIONS TO OBTAIN FULL IRRIGATION COVERAGE FOR THE (E) IRRIGATION SYSTEM, AS NEEDED. IF TRANSIT MAIN LINE IS FOUND, CONSULT WITH ARCHITECT FOR FURTHER DIRECTION PRIOR TO DEMOLITION AND CONSTRUCTION.

1. REROUTE AND INSTALL (N) 6" AND 4" DIA. MAIN LINE AROUND CONTRACT WORK AREA AS SHOWN.
- 2A. POINT OF WATER CONNECTION TO (E) POTABLE 6" DIA. IRRIGATION MAIN LINE PIPING, LOCATION "A": CONNECT (N) MAIN LINE PIPE TO (E) MAIN LINE PIPE AND REROUTE (E) MAIN LINE AS SHOWN. LOCATE BURIED (E) LOW VOLTAGE WIRE BUNDLE ADJACENT TO (E) MAIN LINE AND FROM (E) CONTROLLER. INSTALL A PULL BOX, CUT WIRES, SPLICE (E) CONTROL WIRE TO (N) WIRES AND REROUTE (N) LOW VOLTAGE WIRE ALONGSIDE (N) MAIN LINE TO LOCATION "B".
- 2B. POINT OF WATER CONNECTION TO (E) POTABLE 6" DIA. IRRIGATION MAIN LINE PIPING, LOCATION "B": CONNECT (N) MAIN LINE PIPE TO (E) MAIN LINE PIPE AND REROUTE (E) MAIN LINE AS SHOWN. LOCATE BURIED (E) LOW VOLTAGE WIRE BUNDLE ADJACENT TO (E) MAIN LINE AND FROM (E) CONTROLLER. INSTALL A PULL BOX, CUT WIRES, SPLICE (E) CONTROL WIRE TO (N) WIRES AND REROUTE (N) LOW VOLTAGE WIRE ALONGSIDE (N) MAIN LINE TO LOCATION "A".
3. PULL BOX FOR (N) CONTROL WIRE TO (E) CONTROL WIRE SPLICES. SEE NOTES 2A, 2B AND 9.
4. IRRIGATION CONTROLLER (PEDESTAL MOUNT):  
IRRIGATION CONTRACTOR SHALL PROVIDE AND INSTALL:  
1. THE CONTROLLER, PEDESTAL MOUNTED AT SITE LOCATION AS DIRECTED BY THE DISTRICT.  
2. THE 120 VAC ELECTRICAL CONNECTIONS TO THE CONTROLLER TERMINALS.  
3. THE MAIN SHUT-OFF DEVICE.  
4. LAMINATED IRRIGATION PLANS AND SCHEDULES AS THE SPECIFICATIONS INDICATE.  
5. GROUNDING OF CONTROLLER.  
6. COMMUNICATION WITH THE DISTRICT CENTRAL SERVICE ELECTRICAL CONTRACTOR IS TO PROVIDE AND INSTALL:  
1. THE 120 VAC/15 AMP SERVICE (1 AMP DEMAND) ELECTRICAL SERVICE TO CONTROLLER LOCATION.  
2. THE RIGID STEEL ELECTRICAL CONDUIT, PULL BOXES AND SHEET ELLS FROM ELECTRICAL PEDESTAL TO CONTROLLER LOCATION. WIRE TYPE IN CONDUIT TO MATCH THE PROJECT'S ELECTRICAL SPECIFICATIONS.  
NOTE: LOCATE CONTROLLER TO AVOID OBSTRUCTING WINDOW VIEWS AND OPERATION OF DOORS OR GATES.
5. MOVE (E) ROTOR HEAD TO NEW LOCATION. REPLACE WITH (N) HEAD AS REQUIRED. CUT (E) LATERAL LINE PIPE AND USE THE SPECIFIED LATERAL LINE PIPE FITTINGS TO CONNECT TO (E) LATERAL LINE PIPE.
6. CHANGE (E) TURF ROTOR HEAD FROM A FULL CIRCLE PATTERN TO A PART CIRCLE PATTERN. ADJUST ARC TO PROVIDE EVEN COVERAGE HEAD-TO-HEAD AND CLEAR FENCING AND/OR HARDSCAPE.
7. INSTALL (N) HEAD AS SHOWN AND ADJUST ADJUST ARC TO PROVIDE EVEN COVERAGE HEAD-TO-HEAD AND CLEAR FENCING AND/OR HARDSCAPE.
8. CAP (E) PVC MAIN LINE AT THIS LOCATION, BELOW GRADE.
9. CONNECT (N) PVC MAIN LINE PIPE TO (E) PVC MAIN LINE PIPE WITH SPECIFIED FITTINGS. LOCATE BURIED (E) LOW VOLTAGE WIRE BUNDLE ADJACENT TO (E) MAIN LINE AND FROM (E) CONTROLLER. INSTALL A PULL BOX, CUT WIRES, SPLICE (E) CONTROL WIRE TO (N) WIRES AND REROUTE (N) LOW VOLTAGE WIRE ALONGSIDE (N) MAIN LINE TO SPLICE BOX LOCATION "B".
10. REMOVE (E) RCV WHICH CONTROLLED (E) ROTOR HEADS INSIDE THE CONTRACT WORK AREA, CUT CONTROL WIRES, AND CAP MAIN LINE BELOW GRADE.
11. CONFIRM THAT THE (E) ROTOR HEAD IS STILL IN EFFICIENT WORKING ORDER AND IN USE. ADJUST ARC TO BE PART CIRCLE OPERATION.
12. DRINKING FOUNTAIN PROVIDED UNDER ARCHITECTURAL WORK. SEE ARCHITECTURAL PLANS. CONNECT PVC MAIN LINE PIPE TO DRINKING FOUNTAIN PIPING.
13. 1.5" DIW STUB FOR DRINKING FOUNTAIN AND HOSE BIBS PROVIDED UNDER CIVIL PLANS. SEE CIVIL PLANS.
14. 2" DIW LINE PROVIDED UNDER CIVIL WORK. SEE CIVIL PLANS.
15. (E) 6" IRRIGATION MAIN LINE FROM CAMPUS. CONFIRM EXACT LOCATION IN THE FIELD BY POTHOLES. BEWARE OF (E) CONTROL WIRES WHEN DIGGING.
16. (E) 4" IRRIGATION MAIN LINE FROM CAMPUS. CONFIRM EXACT LOCATION IN THE FIELD BY POTHOLES. BEWARE OF (E) CONTROL WIRES WHEN DIGGING.
17. REVIEW THIS ZONE IN THE FIELD. IF THE ZONE STILL EXISTS, REMOVE RCV AND HEADS FROM (N) PAVEMENT AREA PRIOR TO PAVEMENT CONSTRUCTION. IT IS POSSIBLE THAT THIS ZONE HAS BEEN DEMOLISHED IN THE PAST.
18. REVIEW THIS RCV AND ZONE IN THE FIELD FOR CURRENT OPERATION.
19. CONNECT (N) PVC LATERAL LINE PIPE TO (E) PVC LATERAL LINE PIPE WITH SPECIFIED FITTINGS.
20. VEGETABLE RAISED BEDS: INSTALL A THREADED HOSE CONNECTION "QUICK CONNECT" WITH A SHUT-OFF VALVE AT EACH RAISED GARDEN PLANTER FOR EASY REMOVAL OF SUBSURFACE DRIP TUBE DURING CYCLIC BED PLANTING, TYPICAL FOR 27 PLANTERS. (SAMPLE: 5/8" BRITTEC PERMA-LOC COMPLING VALVE AVAILABLE FROM IRRIGATIONWORKS.COM).

**CONSTRUCTION NOTES:**

1. (E) IRRIGATION INSIDE THE (N) CONTRACT WORK AREA SHALL BE DEMOLISHED AS REQUIRED TO MAKE WAY FOR THE (N) HARDSCAPE/LANDSCAPE CONSTRUCTION. THIS INCLUDES (E) MAIN LINE PIPE, LATERAL LINE PIPE, RCVs, ROTOR HEADS, AND WIRE. WHEN IN DOUBT, CONFER WITH ARCHITECT FOR DIRECTION.
2. THE (E) POTABLE IRRIGATION MAIN LINE SERVING BEAR CREEK HIGH SCHOOL CAMPUS LANDSCAPE AND FIELDS SHALL REMAIN IN SERVICE AND IN GOOD WORKING ORDER AT ALL TIMES. THE CONTRACTOR SHALL PROVIDE THE FOLLOWING RESEARCH AND SERVICES PRIOR TO ACTUAL CONSTRUCTION OF THE NEW WORK:  
A. DISCUSS THE ACTUAL IRRIGATION MAIN LINE PIPE LOCATIONS WITH THE ARCHITECT, STAKE LOCATIONS AS REQUIRED.  
B. POT HOLE TO ESTABLISH WHAT BURIED PIPES ARE IRRIGATION MAIN LINES SERVING THE CAMPUS AND FIELDS (POTABLE WATER) AND THE SCHOOL CAMPUS.
3. **WARNING NOTE FOR (E) RCV WIRING FOUND IN THIS CONTRACT AREA:** (E) RCVs CONTROLLED FROM AND WIRED TO (E) ON-SITE CONTROLLERS MAY BE FOUND DURING EXCAVATION. SALVAGE AND PROTECT (E) CONVENTIONAL CONTROL WIRING FOUND NEXT TO THE (E) PVC MAIN LINE. REROUTE WITH (N) WIRE WHERE NECESSARY TO KEEP THE (E) IRRIGATION SYSTEM IN OPERATION. (E) SPLICED WIRES SHALL BE CONTAINED WITHIN AN APPROVED 14x19 BURIED SPLICE BOX WITH UD SURFACE AT GRADE.

IRRIGATION DESIGNER:  
DATE: 02-17-2021  
SCALE: 1" = 1'-0"



OWNER: LODI UNIFIED SCHOOL DISTRICT

PROJECT NAME: BEAR CREEK HIGH SCHOOL

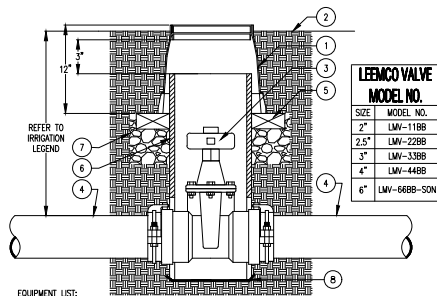
CLIENT ADDRESS: 10556 Thornton Rd, Stockton, CA 95209

REVISIONS:		
DESCRIPTION	DATE	

PROJECT NO: 2020-40119  
DATE ISSUED: 02-17-2021  
SCALE: 1" = 1'-0"  
SHEET NUMBER: **F5.00**  
SHEET TITLE: IRRIGATION PLAN





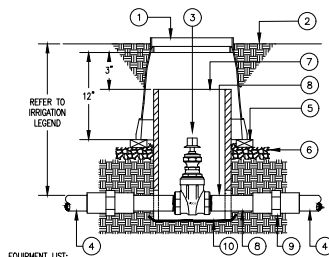


#### EQUIPMENT LIST:

1. 10" ROUND PLASTIC VALVE BOX WITH PLASTIC BOLT-DOWN LID. (REFER TO BUBBLED NUMBERS)
  2. FINISH GRADE
  3. LEMCO GATE VALVE, BELL CONNECTIONS WITH INTEGRAL RESTRAINTS, UNLESS OTHERWISE NOTED, PLACE VALVE IN THE OPEN POSITION. BOLT TORQUE: 3" = 20 FT-LBS; 4", 6" & 8" = 50 FT-LBS.
  4. MAIN LINE PIPE (ACCORDING TO LEGEND AND SPECIFICATIONS)
  5. BRICK BASE (2 TOTAL, 180 DEGREES APART)
  6. 10" SCH. 40 OR CLASS 200 PVC RISER-NOTCH RISER TO FIT OVER PIPE
  7. 3/4" CRUSHED GRAVEL BASE, 6" DEEP, ALL AROUND
  8. METAL WIRE MESH TO PREVENT GOPHER INTRUSION, 1/2" MESH, 19 GA, GALVANIZED
- INSTALLATION NOTES:
1. INSTALL VALVE BOX FLUSH WITH FINISH GRADE IN TURF AND 1" ABOVE FINISH GRADE IN SHRUB AREAS.
  2. KEEP BRICKS AWAY FROM PIPE.

#### 1 GATE VALVE, LEMCO WITH BELL CONNECTIONS & RESTRAINTS (2", 2.5", 3", 4", & 6")

NOT TO SCALE

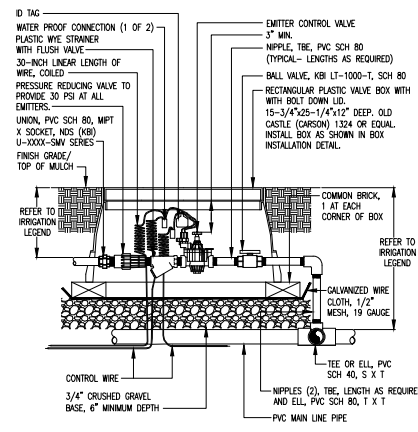


#### EQUIPMENT LIST:

1. 10" ROUND PLASTIC VALVE BOX WITH PLASTIC BOLT-DOWN LID.
  2. FINISH GRADE
  3. GATE VALVE WITH SO, NUT
  4. PVC MAIN LINE, SIZE AND TYPE PER SPECIFICATIONS
  5. COMMON BRICK, 2 TOTAL, 180 DEGREES APART
  6. 3/4" CRUSHED GRAVEL BASE, 6" DEEP, ALL AROUND
  7. 8" DIAMETER PVC VERTICAL SLEEVE FOR ACCESS - NOTCH SLEEVE TO FIT OVER PIPE
  8. NIPPLE, PVC SCH 80, T&E, 2 TOTAL, SIZES EQUAL TO GATE VALVE
  9. FEMALE ADAPTER, PVC SCH 80, S X S, 2 TOTAL, SIZES EQUAL TO GATE VALVE
  10. METAL WIRE MESH TO PREVENT GOPHER INTRUSION, 1/2" MESH, 19 GA, GALVANIZED
- INSTALLATION NOTES:
1. INSTALL VALVE BOX FLUSH WITH FINISH GRADE IN TURF AND 1" ABOVE FINISH GRADE IN SHRUB AREAS.
  2. KEEP BRICKS AWAY FROM PIPE.

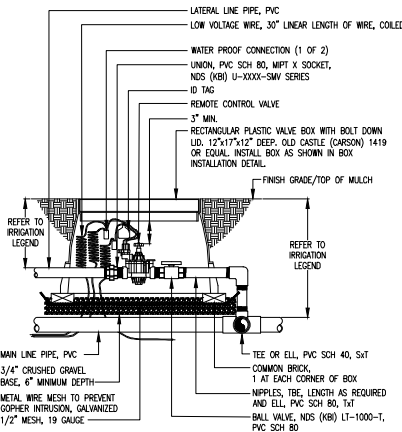
#### 2 GATE VALVE, THREADED (1.5")

NOT TO SCALE



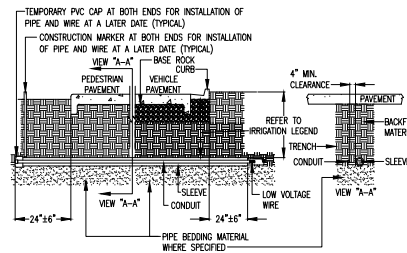
#### 5 EMITTER CONTROL VALVE

NOT TO SCALE



#### 6 REMOTE CONTROL VALVE

NOT TO SCALE



#### LEGEND:

- SLEEVE: 1120-SCHEDULE 40 OR CLASS 200 PS PVC PLASTIC PIPE WITH SCHEDULE 40 PVC COUPLINGS AS REQUIRED. SELECT PVC SLEEVE MATERIAL WITH THE THICKEST WALL DIMENSION, 18" UNDER PEDESTRIAN PAVEMENT; COLOR AS SPECIFIED, 24" COVER MINIMUM - 36" MAXIMUM (SEE LEGEND) UNDER VEHICULAR PAVEMENT, MEASURED FROM TOP OF SLEEVE TO FINISH GRADE OR TOP OF BASE ROCK. PROVIDE SOLVENT WELDED AND WATERPROOF JOINTS.
- CONDUIT: 1120-SCHEDULE 40 PVC GREY ELECTRICAL CONDUIT WITH SCHEDULE 40 PVC GREY COUPLINGS AS REQUIRED, 18" UNDER PEDESTRIAN PAVEMENT; 24" COVER MINIMUM - 36" MAXIMUM (SEE LEGEND) UNDER VEHICULAR PAVEMENT, MEASURED FROM TOP OF SLEEVE TO TOP OF BASE ROCK. PROVIDE SOLVENT WELDED AND WATERPROOF JOINTS.

#### SLEEVING AND CONDUIT INSTALLATION NOTES:

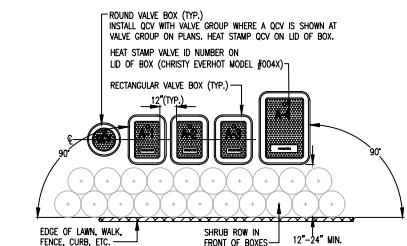
1. INSTALL SLEEVE AND CONDUIT STRAIGHT AND LEVEL.
2. EXTEND SLEEVE AND CONDUIT 24" BEYOND INSIDE FACE OF CURB OR EDGE OF PAVED SURFACE.
3. PROVIDE BED FOR SLEEVE AND CONDUIT, SMOOTH AND FREE OF LARGE ROCKS OR ABRASIVE OBJECTS.
4. IF SLEEVE LENGTH IS GREATER THAN 17', INSTALLATION OF MULTIPLE PIPES BY SLIDING THEM THROUGH THE SLEEVE MAY BE HINDERED BY PVC COUPLINGS. INSTALL MULTIPLE PIPES WITHIN THE SLEEVE DURING THE SLEEVE INSTALLATION AND CONNECT PIPING AT A LATER TIME DURING CONSTRUCTION.
5. INSTALL A NYLON ROPE PULL CORD INSIDE CONDUIT FROM END TO END FOR LOW VOLTAGE WIRE PULL.
6. MECHANICALLY TAMP BACKFILL TO 85% COMPACTION. PROVIDE COMPACTION OF SOIL OVER SLEEVE AND CONDUIT IN A MANNER TO PREVENT COLLAPSE OF SLEEVE OR CONDUIT.
7. INSTALL SCHEDULE 40 PVC CAPS AT ENDS OF SLEEVE OR CONDUIT TO PREVENT ENTRANCE OF DEBRIS INTO SLEEVE, DO NOT GLUE THE CAP.
8. IF PIPING IS TO BE INSTALLED AFTER SLEEVING IS BACKFILLED, MARK SLEEVE LOCATION WITH A FIBERGLASS COMPOSITE MARKING POST (LABELED "IRRIGATION"), EXPOSED AT GRADE, 1. CHRISTY ENTERPRISES MODEL #10-5766-RR. PROVIDE STAKES AT ENDS OF SLEEVE.
9. SEAL ENDS OF SLEEVE AND CONDUIT WITH GROUT TO PREVENT ROOT INTRUSION IN THE SLEEVE.
10. CONDUIT SHALL BE REQUIRED FOR LOW VOLTAGE WIRE INSTALLED UNDER PAVEMENT. REFER TO CHART BELOW.

#### LOW VOLTAGE WIRE CONDUIT SIZING CHART

PVC ELECTRICAL CONDUIT DIAMETER	2" MIN.	2-1/2"	3"	4"
ALLOWABLE NUMBER OF AWG-UF WIRES IN CONDUIT	0-16	17-24	25-40	41-48

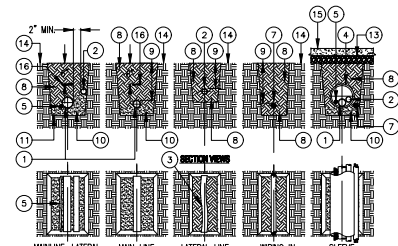
#### 3 SLEEVING AND CONDUIT INSTALLATION DETAIL

NOT TO SCALE



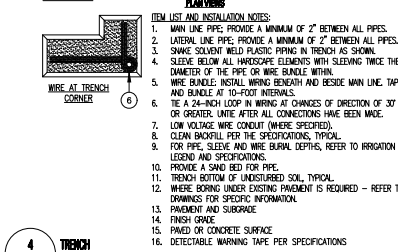
#### 7 BOX INSTALLATION

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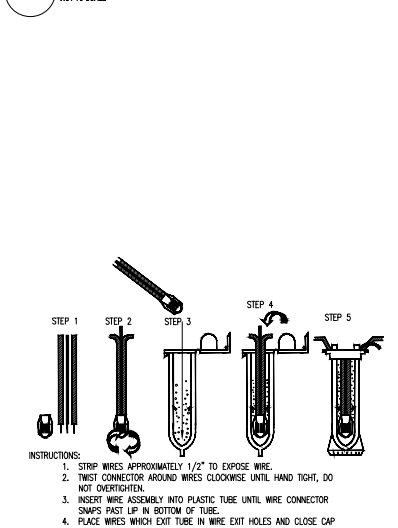
#### 4 TRENCH

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#### 8 WIRE SPLICE

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#### 9 WIRE SPLICE

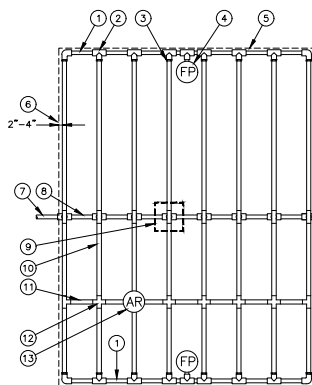
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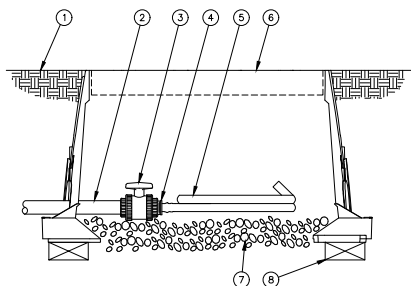




- NOTES:
1. DISTANCE BETWEEN LATERAL ROWS AND EMITTER SPACING TO BE BASED ON SOIL TYPE, PLANT MATERIALS AND CHANGES IN ELEVATION. SEE RAIN BIRD XF-SDI DRIPLINE INSTALLATION GUIDE FOR SUGGESTED SPACINGS.
  2. LENGTH OF LONGEST DRIPLINE LATERAL SHOULD NOT EXCEED THE MAXIMUM LENGTH SHOWN IN THE ACCOMPANYING TABLE.
  3. AIR RELIEF VALVE TO BE INSTALLED AT HIGH POINT OF AREA.
  4. WHEN USING 17MM INSERT FITTINGS WITH DESIGN PRESSURE OVER 50PSI, IT IS RECOMMENDED THAT STAINLESS STEEL CLAMPS BE INSTALLED ON EACH FITTING.

#### XFS SUB-SURFACE DRIPLINE

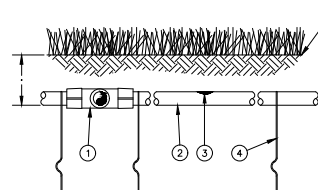
N.T.S. CENTER FEED LAYOUT



1. FINISH GRADE
2. PVC DRIPLINE
3. PVC 1" x 3/4" TRUE UNION BALL VALVE
4. EASY FIT MALE X BARB ADAPTER: RAIN BIRD XFF-MA-075
5. SUB-SURFACE DRIPLINE: RAIN BIRD XF SERIES BLANK TUBING
6. 12-INCH VALVE BOX WITH COVER: RAIN BIRD VB-SD
7. 3-INCH MINIMUM DEPTH OF 3/4" WASHED GRAVEL
8. BRICK (1 OF 2)

#### XFS SUB-SURFACE DRIPLINE

N.T.S. FLUSH POINT WITH BALL VALVE



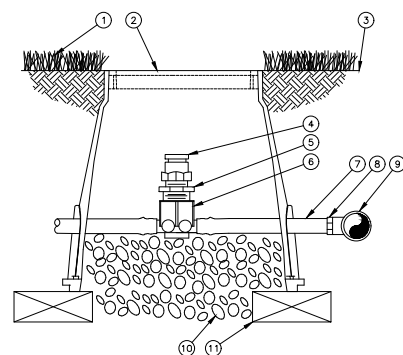
1. EASY FIT COMPRESSION TEE: RAIN BIRD MDCTEE
2. SUB-SURFACE DRIPLINE: RAIN BIRD XF SERIES DRIPLINE POTABLE: XFS DRIPLINE NON-POTABLE: XFSP DRIPLINE
3. INLINE DRIPLINE EMITTER
4. TIE DOWN STAKE: RAIN BIRD TDS-050 WITH BEND (TYPICAL)
5. TURF/FINISH GRADE OR SHRUB BED WITH MULCH

NOTES:

1. PLACE TIE DOWN STAKES EVERY THREE FEET IN SAND, FOUR FEET IN LOAM, AND FIVE FEET IN CLAY.
2. AT FITTINGS WHERE THERE IS A CHANGE OF DIRECTION SUCH AS TEES OR ELBOWS, USE TIE-DOWN STAKES ON EACH LEG OF THE CHANGE OF DIRECTION.
3. INSERTION FLOW AND TRENCHED INSTALLATIONS DO NOT REQUIRE TIE DOWN STAKES.

#### XFS SUB-SURFACE DRIPLINE BURIAL

N.T.S.



#### XFS SUB-SURFACE DRIPLINE

N.T.S.

1/2" AIR RELIEF VALVE IN XFS DRIPLINE

1. PVC EXHAUST HEADER
2. PVC SCH 40 TEE OR EL (TYPICAL)
3. BARB X MALE FITTING: RAIN BIRD XFF-MA FITTING (TYPICAL)
4. FLUSH POINT (TYPICAL) SEE RAIN BIRD DETAIL "XFS FLUSH POINT" OR "XFS FLUSH POINT WITH BALL VALVE"
5. PERIMETER OF AREA
6. PERIMETER DRIPLINE PIPE TO BE INSTALLED 2'-4" FROM PERIMETER OF AREA
7. PVC SUPPLY PIPE FROM RAIN BIRD CONTROL ZONE KIT (SIZED TO MEET LATERAL FLOW DEMAND)
8. PVC SUPPLY MANIFOLD
9. CONNECTION FROM SUPPLY MANIFOLD TO DRIPLINE (TYPICAL)- SEE INSET A
10. SUB-SURFACE DRIPLINE: RAIN BIRD XF SERIES DRIPLINE (TYPICAL) POTABLE: XFS DRIPLINE NON-POTABLE: XFSP DRIPLINE
11. RAIN BIRD XF SERIES BLANK TUBING
12. BARB X BARB INSERT TEE OR CROSS: RAIN BIRD XFF-TEE OR RAIN BIRD XFD-CROSS (TYPICAL)
13. 1/2" AIR RELIEF VALVE: RAIN BIRD MODEL: ARV050 SEE RAIN BIRD XFS DETAILS FOR AIR RELIEF INSTALLATION
14. BARB X FEMALE FITTING: RAIN BIRD XFD-TFA-075 FITTING
15. 3/4" SCH 80 PVC NIPPLE LENGTH AS NECESSARY TO ACHIEVE THE SPECIFIED COVER

Inlet Pressure psi	12" Spacing		18" Spacing		24" Spacing	
	Nominal Flow (gph)	Nominal Flow (gph)	Nominal Flow (gph)	Nominal Flow (gph)	Nominal Flow (gph)	Nominal Flow (gph)
15	273	155	314	250	424	322
20	318	169	353	294	508	368
30	360	230	413	350	586	414
40	395	255	465	402	652	474
50	417	285	528	420	720	488
60	460	290	596	455	780	514

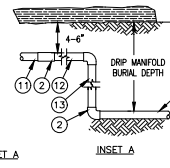
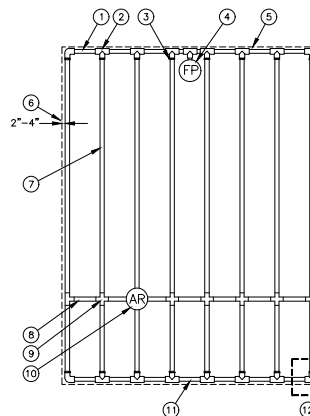
NOTES:

1. DISTANCE BETWEEN LATERAL ROWS AND EMITTER SPACING TO BE BASED ON SOIL TYPE, PLANT MATERIALS AND CHANGES IN ELEVATION. SEE RAIN BIRD XFS DRIPLINE INSTALLATION GUIDE FOR SUGGESTED SPACINGS.
2. LENGTH OF LONGEST DRIPLINE LATERAL SHOULD NOT EXCEED THE MAXIMUM LENGTH SHOWN IN THE ACCOMPANYING TABLE.
3. AIR RELIEF VALVE TO BE INSTALLED AT HIGH POINT OF AREA.
4. WHEN USING 17MM INSERT FITTINGS WITH DESIGN PRESSURE OVER 50PSI, IT IS RECOMMENDED THAT STAINLESS STEEL CLAMPS BE INSTALLED ON EACH FITTING.

#### XFS SUB-SURFACE DRIPLINE

N.T.S.

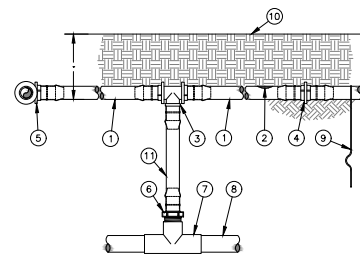
END FEED LAYOUT



1. PVC EXHAUST HEADER
2. PVC SCH 40 TEE OR EL (TYPICAL)
3. BARB X MALE FITTING: RAIN BIRD XFF-MA FITTING (TYPICAL)
4. FLUSH POINT (TYPICAL) SEE RAIN BIRD DETAIL "XFS FLUSH POINT" OR "XFS FLUSH POINT WITH BALL VALVE"
5. PERIMETER OF AREA
6. PERIMETER DRIPLINE PIPE TO BE INSTALLED 2'-4" FROM PERIMETER OF AREA
7. SUB-SURFACE DRIPLINE: RAIN BIRD XF SERIES DRIPLINE (TYPICAL) POTABLE: XFS DRIPLINE NON-POTABLE: XFSP DRIPLINE
8. RAIN BIRD XF SERIES BLANK TUBING
9. BARB X BARB INSERT TEE OR CROSS: RAIN BIRD XFF-TEE OR RAIN BIRD XFD-CROSS (TYPICAL)
10. 1/2" AIR RELIEF VALVE: RAIN BIRD MODEL: ARV050 SEE RAIN BIRD XFS DETAILS FOR AIR RELIEF INSTALLATION
11. PVC SUPPLY HEADER
12. PVC DRIPLINE MANIFOLD FROM RAIN BIRD CONTROL ZONE VALVE KIT (SIZED TO MEET LATERAL FLOW DEMAND)
13. PVC SCH 40 RISER PIPE

Inlet Pressure psi	12" Spacing		18" Spacing		24" Spacing	
	Nominal Flow (gph)	Nominal Flow (gph)	Nominal Flow (gph)	Nominal Flow (gph)	Nominal Flow (gph)	Nominal Flow (gph)
15	273	155	314	250	424	322
20	318	169	353	294	508	368
30	360	230	413	350	586	414
40	395	255	465	402	652	474
50	417	285	528	420	720	488
60	460	290	596	455	780	514

1. TURF GRASS
2. SUBTERRANEAN EMITTER BOX: RAIN BIRD SEB 7XB
3. FINISH GRADE
4. 1/2" AIR RELIEF VALVE: RAIN BIRD ARV050 TO BE INSTALLED AT HIGH POINTS IN DRIPLINE
5. 1/2" x 3/4" PVC REDUCER BUSHING
6. BARB X FEMALE THREAD CONNECTOR: RAIN BIRD XFD-TFA FITTING
7. 1/2" BLANK DRIPLINE TUBING: RAIN BIRD XF SERIES
8. BARB X MALE THREAD CONNECTOR: RAIN BIRD XFF-MA FITTING
9. PVC TEE CONNECTED TO PVC HEADER PIPE
10. 3" MINIMUM DEPTH OF 3/4" WASHED GRAVEL
11. BRICK (1 OF 2)



NOTES:

1. PLACE TIE DOWN STAKES EVERY THREE FEET IN SAND, FOUR FEET IN LOAM, AND FIVE FEET IN CLAY.
2. AT FITTINGS WHERE THERE IS A CHANGE OF DIRECTION SUCH AS TEES OR ELBOWS, USE TIE-DOWN STAKES ON EACH LEG OF THE CHANGE OF DIRECTION.
3. FOR EASE OF CONSTRUCTION, USE THE RAIN BIRD FITTINGS-TOOL XF INSERTION TOOL FOR FITTING ASSEMBLY.

1. ON-SURFACE DRIPLINE: RAIN BIRD XF SERIES DRIPLINE • POTABLE: XFS DRIPLINE • NON-POTABLE: XFSP DRIPLINE
2. INLINE DRIPLINE EMITTER, SEE PLANS FOR DRIPLINE OUTLET SPACINGS.
3. BARB TEE 17x17x17mm RAIN BIRD XFF-TEE
4. BARB COUPLING 17x17mm RAIN BIRD XFF-COUP
5. BARB ELBOW 17x17mm RAIN BIRD XFF-ELBOW
6. BARB MALE ADAPTER • 17mm x 1/2" MPT RAIN BIRD XFF-MA-050 • 17mm x 3/4" MPT RAIN BIRD XFF-MA-075
7. PVC TEE 3/4x1/2
8. PVC LATERAL SUPPLY HEADER
9. TIE DOWN STAKE: RAIN BIRD TDS-050 WITH BEND (TYPICAL)
10. FINISH GRADE
11. RAIN BIRD XF SERIES BLANK TUBING LENGTH AS REQUIRED

IRRIGATION DESIGNER:  
JAMES E. TERRY, LANDSCAPE ARCHITECT  
JAMES E. TERRY & ASSOCIATES, INC.  
10000 S. RAYMOND AVE., SUITE 100  
DALLAS, TEXAS 75241  
(214) 343-1111  
WWW.JET-IRRI.COM

OWNER: LODI UNIFIED SCHOOL DISTRICT

PROJECT NAME: BEAR CREEK HIGH SCHOOL

CLIENT ADDRESS: 10556 Thornton Rd, Stockton, CA 95209



REVISIONS:

DESCRIPTION	DATE

PROJECT NO: 2020-40119

DATE ISSUED: 02-17-2021

SCALE: NTS

SHEET NUMBER: F5.04

SHEET TITLE: IRRIGATION DETAILS



# LEEMCO FITTING & JOINT RESTRAINT CONSTRUCTION DETAILS (also refer to the Leemco's current guidelines and recommendations)

## LEEMCO JOINT RESTRAINTS DISTANCE TABLES:

### SIZE REDUCTION, REDUCERS

TABLES BELOW SHOW "L" DISTANCES IN FEET. WHEN AN ADJACENT JOINT TO A REDUCER OR A REDUCING TEE IS WITHIN THIS DISTANCE, OTHER JOINTS ON THE LARGER DIAMETER END MUST BE RESTRAINED.

TABLE VALUES ARE LISTED FOR 125 PSI LINE PRESSURE.

TABLE VALUES ARE BASED ON TYPE 3 TRENCHING AND COMPACTNESS METHOD, 30" COVER AND A SAFETY FACTOR OF 2. DESIGN COVER IS 36".

### BENDS, DEAD ENDS

TABLES BELOW SHOW "L" DISTANCES. WHEN AN ADJACENT JOINT TO A BEND IS WITHIN THIS DISTANCE, THE JOINT MUST BE RESTRAINED. FOR BENDS ADJACENT JOINTS ON BOTH SIDES OF THE BEND REQUIRE RESTRAINTS. USE THE 90-DEGREE BEND VALUES FOR THE SIDE (BRANCH) OUTLET OF TEES.

TABLE VALUES ARE LISTED FOR 125 PSI LINE PRESSURES.

TABLE VALUES ARE BASED ON TYPE 3 TRENCHING AND COMPACTNESS METHOD, 30" COVER AND A SAFETY FACTOR OF 2. DESIGN COVER IS 36".

### SANDY-CLAY SOIL MIXTURE

PIPE SIZE	DEGREE OF BEND					DEAD END
	15"	22"	45"	90"		
3"	2	3	5	11	30	
4"	2	4	9	20	45	
6"	3	6	13	29	63	

### SANDY-CLAY SOIL MIXTURE

SIZE REDUCTION	TABLE A-125 PSI LINE PRESSURE	
	DISTANCE IN FEET	
3 x 2	10	
3 x 2.5	8	
4 x 2	31	
4 x 2.5	20	
4 x 3	14	

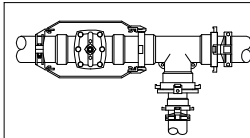


FIG. 1. TOP AND SIDE VIEW OF THE RESTRAINED GATE VALVE. THE 58-LY LINK BOLT ONTO THE LUGS OF THE FITTING. THE RESTRAINT BARS SPREAD ACROSS THE VALVE AND ATTACH TO THE JOINT RESTRAINT SECURED TO THE PIPE.

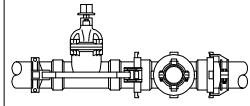


FIG. 2. 58-LY LINK BOLT ONTO THE LUGS OF THE FITTING.

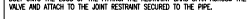


FIG. 3. THE 58-LY LINK BOLT HERE IS USED TO RESTRAIN ANY PLANGED PRODUCT SUCH AS A PLANGED GLOBE VALVE.

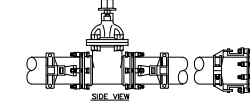


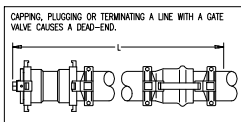
FIG. 4. THE 58-LY LINKS ATTACH TO THE FLANGE OF AN 84 VALVE OR A PLANGED GLOBE.

### 1 GATE VALVES, MJ & PLANGED CONNECTIONS

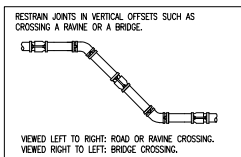
NOT TO SCALE

#### NOTES:

- A DEAD-END WILL REQUIRE SEVERAL UPSTREAM JOINTS TO BE RESTRAINED. REFER TO DISTANCE CHART FOR NUMBER OF UPSTREAM JOINTS TO BE RESTRAINED.
- WHEN CROSSING A RAVINE, ROADWAY, OR A STREAM BED, USE JOINT RESTRAINTS ON ALL JOINTS TO PREVENT BUCKLING.



DEAD-END RESTRAINT



BRIDGE, RAVINE, ROAD OR RAVINE CROSSING

### 5 LEEMCO DEAD-END OR CROSSINGS

NOT TO SCALE

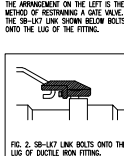


FIG. 2. 58-LY LINK BOLT ONTO THE LUGS OF THE FITTING.

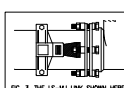


FIG. 3. THE 58-LY LINK BOLT HERE IS USED TO RESTRAIN ANY PLANGED PRODUCT SUCH AS A PLANGED GLOBE VALVE.

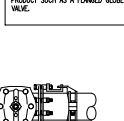


FIG. 4. THE 58-LY LINKS ATTACH TO THE FLANGE OF AN 84 VALVE OR A PLANGED GLOBE.

#### NOTES:

- ALTHOUGH A GATE VALVE ACTS AS A DEAD-END WHEN SHUT-OFF, THE CONNECTING PIPES ON BOTH SIDES OF THE VALVE, ACT AS THROU BLOCKS AND ELIMINATE THE NEED FOR RESTRAINING ADJACENT JOINTS.
- THE ADJACENT JOINT TO A GATE VALVE WILL REQUIRE RESTRAINTS WHEN IT IS WITHIN THE "L" DISTANCE OF A BEND, A REDUCER OR A DEAD END.
- GATE VALVES LOCATED NEXT TO A TEE USE LEEMCO LUG SERIES JOINT RESTRAINTS.



FIG. 1. A GATE VALVE ON A LONG MAIN LINE WITH NO BENDS OR REDUCERS IN CLOSE PROXIMITY DOES NOT REQUIRE THE ADJACENT JOINTS TO BE RESTRAINED.

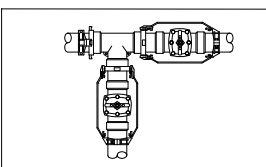


FIG. 2. GATE VALVE INSTALLATION

### 2 PUSH-ON GATE VALVES

NOT TO SCALE

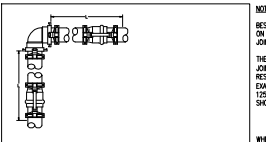


FIG. 1. 90 DEGREE BEND

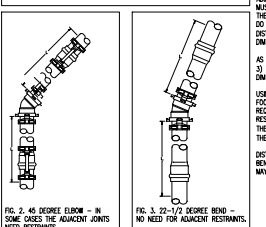


FIG. 2. 45 DEGREE ELBOW - IN SOME CASES THE ADJACENT JOINTS NEED RESTRAINTS.

### 6 ELBOW RESTRAINTS

NOT TO SCALE

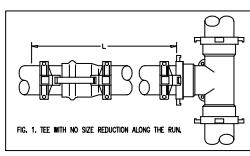


FIG. 1. TEE WITH NO SIZE REDUCTION ALONG THE RUN.

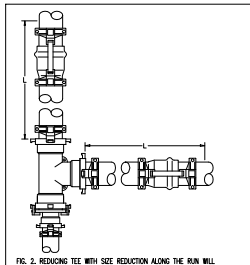


FIG. 2. REDUCING TEE WITH SIZE REDUCTION ALONG THE RUN WILL REQUIRE A JOINT RESTRAINT ON THE LARGER DIAMETER PIPE.

### 3 TEE RESTRAINTS

NOT TO SCALE

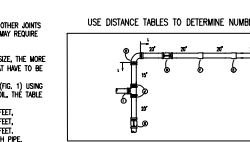


FIG. 1. 90 DEGREE BEND

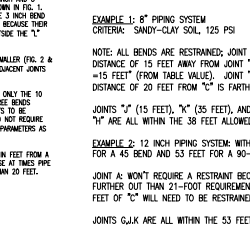


FIG. 2. 45 DEGREE ELBOW - IN SOME CASES THE ADJACENT JOINTS NEED RESTRAINTS.

### 7 WORKING WITH THE DISTANCE TABLES

NOT TO SCALE

#### NOTES:

- A BRANCH OF A TEE IS TREATED AS A 90-DEGREE BEND. DIRECTION OF FLOW IS NOT RELATIVE TO RESTRAINING A JOINT.
- A BRANCH OF A TEE IS TREATED AS A 90-DEGREE BEND. DIRECTION OF FLOW IS NOT RELATIVE TO RESTRAINING A JOINT.

A TEE WITH NO SIZE REDUCTION ALONG THE RUN REQUIRES JOINT RESTRAINTS ONLY ON ITS BRANCH AS IN FIG. 1. JOINT RESTRAINTS WILL BE REQUIRED ALONG THE RUN ONLY WHEN THE TEE IS WITHIN THE "L" DISTANCE OF ANOTHER BEND OR A REDUCER.

USE THE DISTANCE TABLES FOR 90-DEGREE BENDS TO DETERMINE HOW MANY OTHER JOINTS ALONG THE BRANCH REQUIRE RESTRAINTS.

A TEE WITH A SIZE REDUCTION ALONG THE RUN REQUIRES JOINT RESTRAINTS ON THE TEE ITSELF AND ON OTHER JOINTS ALONG THE LARGER DIAMETER RUN AS ILLUSTRATED IN FIG. 2.

USE DISTANCE TABLES FOR REDUCERS TO DETERMINE HOW MANY OTHER JOINTS ALONG THE RUN REQUIRE RESTRAINTS.

NOTE: ALL DI FITTINGS SHALL BE WRAPPED COMPLETELY WITH T. CHRISTY POLYETHYLENE FITTING WRAP SECURED WITH CHRISTY'S PIPE WRAP TAPE.

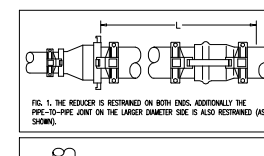


FIG. 1. THE REDUCER IS RESTRAINED ON BOTH ENDS. ADDITIONALLY THE PIPE-TO-PIPE JOINT ON THE LARGER DIAMETER SIDE IS ALSO RESTRAINED (AS SHOWN).

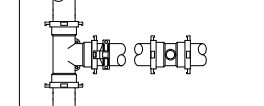


FIG. 2. SERVICE TEES INSTALLED OUTSIDE THE "L" DISTANCE OF A TEE REQUIRES NO JOINT RESTRAINTS.

### 4 REDUCERS & TAPPED TEES

NOT TO SCALE

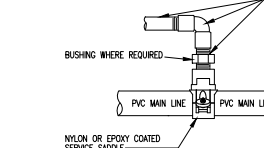


FIG. 1. THE REDUCER IS RESTRAINED ON BOTH ENDS. ADDITIONALLY THE PIPE-TO-PIPE JOINT ON THE LARGER DIAMETER SIDE IS ALSO RESTRAINED (AS SHOWN).

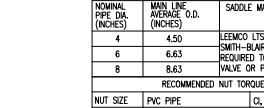


FIG. 2. SERVICE TEES INSTALLED OUTSIDE THE "L" DISTANCE OF A TEE REQUIRES NO JOINT RESTRAINTS.

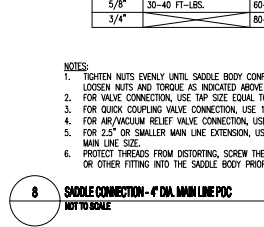


FIG. 3. THE REDUCER IS RESTRAINED ON BOTH ENDS. ADDITIONALLY THE PIPE-TO-PIPE JOINT ON THE LARGER DIAMETER SIDE IS ALSO RESTRAINED (AS SHOWN).

### 8 SADDLE CONNECTION - 4" DIA. MAIN LINE PVC

NOT TO SCALE



FIG. 1. THE REDUCER IS RESTRAINED ON BOTH ENDS. ADDITIONALLY THE PIPE-TO-PIPE JOINT ON THE LARGER DIAMETER SIDE IS ALSO RESTRAINED (AS SHOWN).

NOTE: 1. TIGHTEN NUTS EVENLY UNTIL SADDLE BODY CONFORMS SMOOTHLY TO PIPE. LOOSEN NUTS AND TORQUE AS INDICATED ABOVE OR BY MANUFACTURER. 2. FOR VALVE CONNECTION, USE TAP SIZE EQUAL TO THE VALVE. 3. FOR QUICK COUPLING VALVE CONNECTION, USE 1" TPT TAP SIZE. 4. FOR AIR/VACUUM RELIEF VALVE CONNECTION, USE 1" TPT TAP SIZE. 5. FOR 2.5" OR SMALLER MAIN LINE EXTENSION, USE TAP SIZE EQUAL TO MAIN LINE SIZE. 6. PROTECT THREADS FROM DISTORTING, SCREW THE COPPERATION STOP OR OTHER FITTINGS INTO THE SADDLE BODY PRIOR TO FINAL TIGHTENING.

IRRIGATION DESIGNER:  
DATE: 11/11/2021  
BY: [Signature]  
FOR: [Signature]  
PROJECT: 2020-40119  
SHEET: 5 OF 5  
SHEET TITLE: IRRIGATION DETAILS

OWNER: LODI UNIFIED SCHOOL DISTRICT

PROJECT NAME: BEAR CREEK HIGH SCHOOL

CLIENT ADDRESS: 10556 Thornton Rd, Stockton, CA 95209



#### REVISIONS:

DESCRIPTION	DATE

PROJECT NO: 2020-40119

DATE ISSUED: 02-17-2021

SCALE: NTS

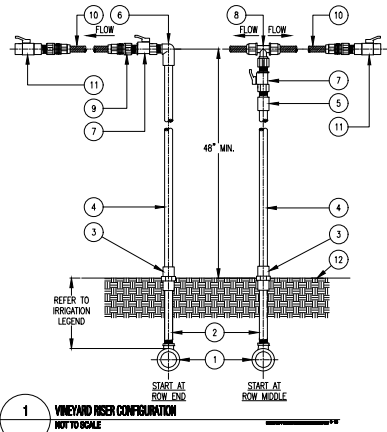
SHEET NUMBER: F5.05

SHEET TITLE: IRRIGATION DETAILS

farmscope

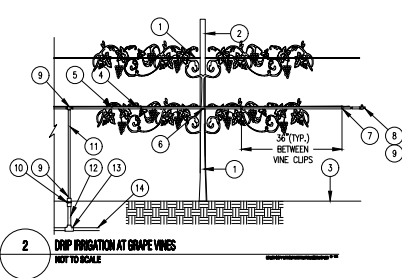
# ITEM LIST AND EQUIPMENT NOTES:

1. PVC LATERAL LINE PER LEGEND
2. NIPPLE, PVC, 1/2"
3. FEMALE ADAPTER, PVC, S x S
4. FLEXIBLE PVC HOSE, 1/2" IPS, JAN, SALCO, OR EQUAL
5. MALE ADAPTER, BLACK PVC, WHT X SOCKET, IRRITEC CS-HMS/2
6. ELBOW, BLACK PVC, WHT X SOCKET, IRRITEC CS-SI/2HT
7. BALL VALVE, BLACK PVC, FHT X WHT, IRRITEC A2-WHT5
8. SWIVEL TEE, FHT X PERMA-LOC X PERMA-LOC, IRRITEC A1-HTS
9. SWIVEL ADAPTER, FHT X PERMA-LOC, IRRITEC A1-HTS
10. DIAPHRAGM TO VINES: RAIN BIRD AS PCS SERIES PRESSURE COMPENSATING AG DIAPHRAGM
11. END FLUSH VALVE: IRRITEC A2-HWPI/2I
12. FINISH GRADE



## EQUIPMENT LEGEND

- (REFER TO BUBBLED NUMBERS)
1. GRAPE VINE (SEE LANDSCAPE PLANS)
  2. VINE STAKE (SEE LANDSCAPE PLANS)
  3. FINISH GRADE
  4. VINE CABLE (SEE LANDSCAPE PLANS)
  5. POLYETHYLENE EMITTER TUBING ON ONE SIDE OF VINE (PRIMARY LINE); POLYETHYLENE BLANK TUBING ON OTHER SIDE OF VINE (SECONDARY LINE); 2 PE DRIP TUBES TOTAL: RAIN BIRD, SEE LEGEND.
  6. EMITTERS, 2 TOTAL, TO DRIP ON EACH SIDE OF VINE
  7. VINE LINE CLIP: IRRITECH BS-SQ-CLIP, CLIP PE TUBE TO LOWER VINE CABLE WITH CURL
  8. MANUAL FLUSH VALVE: ROTATE TO THE CLOSED POSITION; USE AS NEEDED FOR FLUSHING THE DRIP TUBING.
  9. ELBOW OR TEE, SEE RISER DETAIL
  10. SCH 40 PVC FEMALE COUPLING, S x T
  11. 1/2" PVC FLEXIBLE IPS HOSE, SALCO OR EQUAL
  12. SCH 80 PVC THREADED NIPPLE, TEE
  13. SCH 40 PVC TEE, S x S x T
  14. PVC LATERAL LINE



## IRRIGATION SCHEDULES

### MATCHED PRECIPITATION RATE SPRAY IRRIGATION @ SHRUB AREAS - SLA

MANUFACTURER/RAIN BIRD		PI RATES/CH/INCHES/1.7											
MODEL/PIE PLAN		SPEEDS FACTOR/0.5											
PIE/30		IRRIGATION EFFICIENCY/0.75											
SPACING/FEET/18		SOL INFILTRATION RATES/INCHES/0.2											
GPM/1.0		YEAR 2 REDUCTION AMOUNT/10											
MONTH	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOTAL
ADJUSTED (EV/INCH/INCHES)	0.8	1.6	2.9	4.7	6.2	7.4	8.1	6.8	5.4	3.3	1.5	0.8	48.1
ADJUSTED (EV/INCH/INCHES)	0.2	0.4	0.7	1.1	1.4	1.7	1.8	1.6	1.2	0.7	0.3	0.1	
MINUTES PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER DAY	1	1	1	1	1	1	1	1	1	1	1	1	
CYCLES PER DAY TO MEET SOL INFILTRATION RATE	1	1	1	1	1	1	1	1	1	1	1	1	
WML RUN TIME (MINUTES) PER CYCLE	1	1	1	1	1	1	1	1	1	1	1	1	

### STREAM ROTATOR IRRIGATION @ SHRUB AREAS - SLA

MANUFACTURER/RAIN BIRD		PI RATES/CH/INCHES/1.7											
MODEL/PIE PLAN		SPEEDS FACTOR/0.5											
PIE/30		IRRIGATION EFFICIENCY/0.75											
SPACING/FEET/18		SOL INFILTRATION RATES/INCHES/0.2											
GPM/1.0		YEAR 2 REDUCTION AMOUNT/10											
MONTH	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOTAL
ADJUSTED (EV/INCH/INCHES)	0.8	1.6	2.9	4.7	6.2	7.4	8.1	6.8	5.4	3.3	1.5	0.8	48.1
ADJUSTED (EV/INCH/INCHES)	0.2	0.4	0.7	1.1	1.4	1.7	1.8	1.6	1.2	0.7	0.3	0.1	
MINUTES PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER DAY	1	1	1	1	1	1	1	1	1	1	1	1	
CYCLES PER DAY TO MEET SOL INFILTRATION RATE	1	1	1	1	1	1	1	1	1	1	1	1	
WML RUN TIME (MINUTES) PER CYCLE	1	1	1	1	1	1	1	1	1	1	1	1	

### BUBBLER IRRIGATION @ STAND ALONE TREES - SLA

MANUFACTURER/RAIN BIRD		TREE CANOPY/SELF/17.8											
MODEL/PIE PLAN		SPEEDS FACTOR/0.5											
PIE/30		IRRIGATION EFFICIENCY/0.75											
SPACING/FEET/18		SOL INFILTRATION RATES/INCHES/0.2											
GPM/1.0		YEAR 2 REDUCTION AMOUNT/10											
MONTH	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOTAL
ADJUSTED (EV/INCH/INCHES)	0.8	1.6	2.9	4.7	6.2	7.4	8.1	6.8	5.4	3.3	1.5	0.8	48.1
ADJUSTED (EV/INCH/INCHES)	0.2	0.4	0.7	1.1	1.4	1.7	1.8	1.6	1.2	0.7	0.3	0.1	
MINUTES PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER DAY	1	1	1	1	1	1	1	1	1	1	1	1	
CYCLES PER DAY TO MEET SOL INFILTRATION RATE	1	1	1	1	1	1	1	1	1	1	1	1	
WML RUN TIME (MINUTES) PER CYCLE	1	1	1	1	1	1	1	1	1	1	1	1	

### SINGLE-OUTLET EMITTER IRRIGATION @ GRAPE VINES - SLA

MANUFACTURER/RAIN BIRD		TOTAL NUMBER OF EMITTER OUTLETS/2											
MODEL/PIE PLAN		TOTAL GPM OF EMITTERS/207											
PIE/30		MICROCLIMATE FACTOR/0.5											
SPACING/FEET/18		IRRIGATION EFFICIENCY/0.75											
GPM/1.0		YEAR 2 REDUCTION AMOUNT/10											
MONTH	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOTAL
ADJUSTED (EV/INCH/INCHES)	0.8	1.6	2.9	4.7	6.2	7.4	8.1	6.8	5.4	3.3	1.5	0.8	48.1
ADJUSTED (EV/INCH/INCHES)	0.2	0.4	0.7	1.1	1.4	1.7	1.8	1.6	1.2	0.7	0.3	0.1	
MINUTES PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER DAY	1	1	1	1	1	1	1	1	1	1	1	1	
CYCLES PER DAY TO MEET SOL INFILTRATION RATE	1	1	1	1	1	1	1	1	1	1	1	1	
WML RUN TIME (MINUTES) PER CYCLE	1	1	1	1	1	1	1	1	1	1	1	1	

### SUBSURFACE DRIPLINE - SHRUB - SLA - 1\"/>

MANUFACTURER/RAIN BIRD		SPEEDS FACTOR/0.5											
MODEL/PIE PLAN		MICROCLIMATE FACTOR/0.5											
PIE/30		IRRIGATION EFFICIENCY/0.75											
SPACING/FEET/18		SOL INFILTRATION RATES/INCHES/0.2											
GPM/1.0		YEAR 2 REDUCTION AMOUNT/10											
MONTH	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	TOTAL
ADJUSTED (EV/INCH/INCHES)	0.8	1.6	2.9	4.7	6.2	7.4	8.1	6.8	5.4	3.3	1.5	0.8	48.1
ADJUSTED (EV/INCH/INCHES)	0.2	0.4	0.7	1.1	1.4	1.7	1.8	1.6	1.2	0.7	0.3	0.1	
MINUTES PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER WEEK	1	1	1	1	1	1	1	1	1	1	1	1	
WATER PER DAY	1	1	1	1	1	1	1	1	1	1	1	1	
CYCLES PER DAY TO MEET SOL INFILTRATION RATE	1	1	1	1	1	1	1	1	1	1	1	1	
WML RUN TIME (MINUTES) PER CYCLE	1	1	1	1	1	1	1	1	1	1	1	1	

## IRRIGATION MAWA-ETWU CALCULATIONS

Maximum Applied Water Allowance (MAWA) for School Projects

Formula: MAWA = (ETOL/62)(4.5 x LA)(1-(0.65) x SA)									
Reference Annual Eto (In./Year) = 48.1									
MAWA = 48.1 x 0.62 x [0.65 x LA + ((1-0.65) x SA)]									
MAWA = 48.1 x 0.62 x 8.336 + 4.811									
MAWA = 416.316 Gallons									
Controller 'C' - Estimated Total Water Use (ETWU)									
Zone/Vine Number or Hydrozone (a)	Plant Water Use Type (b)	Infiltration Method (c)	Plant Factor (PF) (d)	Irrigation Efficiency (E) (e)	ETAF (PF/E) (f)	Hydrozone Landscape Area (LA) (sq. ft.) (g)	ETAF x Area (h)	Total Water Use (i)	Estimate Total Water Use (ETWU) (j)
C01	SLA	R-PART-SHRUB	1.0	1.00	1.00	2,250	2,250.0	2,250.0	48
C02	SLA	R-PART-SHRUB	1.0	1.00	1.00	1,150	1,150.0	1,150.0	24
C03	SLA	R-PART-SHRUB	1.0	1.00	1.00	2,250	2,250.0	2,250.0	48
C04	SLA	S-SHRUB	1.0	1.00	1.00	965	965.0	965.0	20
C05	SLA	S-SHRUB	1.0	1.00	1.00	715	715.0	715.0	15
C06	SLA	S-SHRUB	1.0	1.00	1.00	715	715.0	715.0	15
C07	SLA	S-SHRUB	1.0	1.00	1.00	1,051	1,051.0	1,051.0	22
C08	SLA	D-SHRUB DRIPLINE	1.0	1.00	1.00	289	289.0	289.0	6
C09	SLA	D-SHRUB	1.0	1.00	1.00	2,312	2,312.0	2,312.0	49
C10	SLA	B-TREE	1.0	1.00	1.00	20	20.0	20.0	0
C11	SLA	B-TREE	1.0	1.00	1.00	9	9.0	9.0	0
C12	SLA	B-TREE	1.0	1.00	1.00	15	15.0	15.0	0
Total Landscape Area Sum						(A)	(B)	(C)	
Regular Landscape Sum						(A)	(B)	(C)	
SLA Sum						(A)	(B)	(C)	
								ETWU Total	416
								Minimum Allowed Water Allowance (MAWA) (g)	416
ETWU=MAWA-Minimum Allowed Water Allowance (MAWA) (g) = 0									
ETWU=MAWA-Minimum Allowed Water Allowance (MAWA) (g) = 0									

NOTE: Only the value of area of each landscape area may not appear with the landscape plan data. The irrigation data calculates the square footage of each zone based upon a 4' x 4' grid. The value of the area of each zone should include the value of 4' x 4' as a plant factor.

NOTE: The total landscape area sum of landscaped areas may not agree with the landscape plan data. The irrigation design calculates the square footage of each area based upon a 4\"/>

(f) ETWU (Annual Closures Required) = Eto x 0.62 x [ETAF x LA + ((1-ETAF) x SA)]

(g) MAWA (Annual Closures Allowed) = Eto x 0.62 x [ETAF x LA + ((1-ETAF) x SA)]

Regular Landscape Areas		ETAF Calculations	
Total ETAF x Area	(B)		
Total Area	(A)(C)		
Average ETAF	B/A		

All Landscape Areas	
Total ETAF x Area	(B)(D)
Total Area	(A)(C)
Average ETAF	(B)(D)/(A)(C)

Summary Hydrozone Information Table	
Hydrozone	Area (Sq. Ft.)
High Water Use	0
Low Water Use	0
Very Low Water Use	0
SLA	13,747
Total =	13,747

IDENTIFICATION STAMP  
OF THE STATE ARCHITECT  
APP: 02-118800 INC.  
REVIEWED FOR:  
DATE: 03/23/2021  
PLANNING/DESIGN/REVIEW/REMENT  
JDE PROJECT NO: 200