

**ADDENDUM NO. 2**  
**DEWATERING SYSTEM UPGRADE FOR WWTP PROJECT**  
**APRIL 29, 2010**

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PROJECT TITLE: City of Buellton: DEWATERING SYSTEM UPGRADE FOR WWTP PROJECT

The following changes additions and clarifications are hereby made part of the contract documents for the above referenced project and shall be taken into account in the preparation of all proposals and the execution of all work. Work shall conform to the requirements of the original contract documents and addenda wherever they apply.

All bidders shall acknowledge receipt of this addendum on the bid proposal form.

**1.) A Pre-bid Job Walk has been scheduled for Thursday, May 13<sup>th</sup> at 9:00 am. All potential bidders should meet at the entrance to the City's Waste Water Treatment Plant (WWTP) located at 79 Industrial Way, Buellton. The tour is anticipated to last 30-60 minutes.**

**Although the Pre-bid Job Walk is NOT mandatory, attendance is strongly encouraged. This will be the only opportunity to visit the WWTP prior to bidding.**

**2.) D2.38 Electrical Work -** the section should be corrected to state the following:

“All electrical work shall conform to Section 16000 – Electrical (*pursuant to Section 16000 as provided in Appendix AP2*), and shall be installed per the electrical drawings of the project construction plans.

**END OF ADDENDUM**

## SECTION 16000

## ELECTRICAL

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.02 SUMMARY

Work in general includes, but is not limited to, the following:

- A. Underground Service – 277/480 volt, three phase, four wire.
- B. Grounding of equipment, service, etc.
- C. Complete lighting and power system as shown on Drawings and specified herein, including conduit, wiring, panelboards, circuit breakers, relays, switches, receptacles, and other items necessary for complete and operable systems.
- D. Electrical connection of equipment furnished by others as shown on the Drawings.
- E. Control wiring and installation and connections of control devices as specified herein.
- F. Mini Power Zone with transformer and panel.
- G. Trenching and backfill as required for electrical Work.
- H. Concrete Work as specified herein.

1.03 SITE VISITS, COORDINATION OF CONTRACT DOCUMENTS,  
VERIFICATION OF DIMENSIONS

- A. Examine existing conditions as applicable. Become acquainted with Specifications and Drawings for all portions of the Project. Notify Project Manager of apparent discrepancies and of inconsistency between the Specifications and the existing conditions. Secure and follow Project Manager's instructions. The Drawings serve as working drawings only, indicating diagrammatically the general layout of the systems and their various components and equipment.
- B. Scaled and figured dimensions are approximate and are given for estimate purposes only. Carefully check and verify dimensions and sizes in order to determine if equipment and materials will fit together and if the dimensions of the assembly are compatible with the space provided. Where equipment is furnished by others, verify that dimensions and

requirements for assembly are compatible with the space provided before proceeding with the roughing-in connections. Field verifications of locations shown on Drawings are necessary since actual locations, distances, mounting heights, etc., may be affected by field conditions. The right is reserved to make reasonable changes in locations of equipment or other features shown on Drawings prior to rough-in without additional cost to the Owner.

- C. Where apparatus and equipment have been indicated on the Drawings, dimensions have been taken from typical equipment of the class indicated. Carefully check the Drawings to see that the contemplated equipment will fit into the spaces provided, regardless of whether or not it may have been approved for quality and utility as an equal.
- D. Rough in all equipment, fixtures, etc., as designated on the Drawings and as specified herein. The Drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large-scale certified Drawings. The Contractor shall obtain all certified rough-in information before progressing with any Work for rough-in connections.
- E. Be responsible for providing outlets and services of proper size at the required locations.
- F. Coordinate requirements of equipment furnished by others, prior to ordering and installation.
- G. No allowance will be made for extra expense due to failure or neglect to follow foregoing directives.

#### 1.04 RULES AND REGULATIONS

- A. Materials and installation shall be in accordance with current rules and requirements of California Code of Regulations and local codes and ordinances including, but not necessarily limited to, the following:
  - 1. The California Electrical Code.
  - 2. Title 8, Chapter 4, California Code of Regulations (Low Voltage Electrical Safety Orders).
  - 3. Local Building Codes.
  - 4. California State Fire Marshal.
  - 5. Certified Ballast Manufacturers' Association (CBM).
  - 6. Uniform Building Code.
  - 7. NEMA (National Electrical Manufacturers Assoc.).
  - 8. IEEE (Institute of Electrical and Electronic Engineers).
  - 9. IPCEA (Insulated Power Cable Engineers Association).

10. ANSI (American National Standards Institute).
  11. ASTM (American Society for Testing and Materials).
  12. UL (Underwriters Laboratories).
  13. OSHA (Occupational Safety & Health Act) Federal.
  14. Title 24, CCR.
  15. NFPA (National Fire Protection Association).
  16. NESC (National Electrical Safety Code).
  17. NECA Standards of Installation.
- B. Where these Specifications call for a higher standard than the above-mentioned rules, the Specifications shall govern.
- C. Should there be any direct conflict between the above mentioned rules and these Specifications, the rules shall govern.
- D. Nothing in the Drawings or Specifications is to be construed to permit Work not conforming to the rules, codes, and regulations.
- E. All materials utilized shall be new and the best of their respective grades or kinds.

#### 1.05 DEFINITIONS

- A. Article 100 of the California Electrical Code shall serve as a guide for definitions.
- B. Industry standard definitions.
- C. Specific Definitions:
1. Concealed: Hidden from sight, as in trenches, chases, hollow construction, above furred spaces, suspended ceilings (acoustical or plastic type), or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.
  2. Exposed: Not concealed.
  3. Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the "Finish Schedule" with exposed and unpainted construction for walls, floor or ceilings, or specifically mentioned as "unfinished".

4. Finished Spaces: Any space ordinarily visible to the visiting public, including exterior areas.

#### 1.06 RULES OF LOCAL UTILITY COMPANIES

- A. Comply with rules and regulations of the serving utility companies, and before submitting bid, check and include applicable service costs for the Project.

#### 1.07 RECOGNIZED TEST LAB

- A. All equipment specified or installed under this project shall be listed by a recognized test lab and bear that label of approval.

#### 1.08 PERMITS AND FEES

- A. Procure licenses and permits necessary for the completion of the Work, and inspection and other applicable fees. Before final payment, deliver to the Owner certificates and permits, approved and signed by the authorities having jurisdiction.

#### 1.09 RECORD DRAWINGS

- A. Include under this Work complete and accurate record information both during construction and before final acceptance by the Owner, and costs associated therewith shall be included under this Work.
- B. Obtain from the Project Manager, at cost, a complete set of applicable blue-line prints. On these prints, systematically and accurately keep an up-to-date and legible dimensional record of Work installed differently from the location or manner indicated by the Drawings, as well as exact locations of stub-outs and hidden or underground features. Have these Drawings readily available for reference and review. When job status permits, submit them to the Project Manager and amend or correct and re-submit if requested.
- C. When the above information is complete and acceptable, deliver Record Drawings to the Project Manager.

#### 1.10 SUBMITTALS - SUBSTITUTIONS

- A. Bids shall be based on Drawings and Specifications and references exactly as shown except as substitutions are permitted under terms of the Instructions to Bidders. Acceptance by the Project Manager of a variation or alternate shall not of itself waive other requirements of the Drawings and Specifications.
- B. Before a substitute is used, it shall be equal in quality and utility to the material or make of equipment specified, and furthermore, shall be suitable for the particular application. The decision of the Project Manager as to the quality and utility of the substitute offered shall be final.

- C. When submitting a substitute to a specified item, provide complete data for both the specified item and the substitute. Complete data includes:
1. Catalog cuts with complete dimensions, characteristics, electrical properties, Underwriter's Laboratory listing, harmonics, light output, mounting and support requirements.
  2. Calculations, photometrics, system load data, energy effect on system, etc.
- If the substitute is not deemed equal in both utility and quality to the specified item, the specified item will be approved and it shall be provided by the Contractor.
- D. Submit in one package complete systematized lists of equipment and Drawings, catalog cuts, brochures, capacity tables and curves, descriptive information, performance data and guarantees and warranties referenced either to applicable Specification paragraphs or to item numbers as shown on the Drawings, or both. Submit six (6) copies.
- E. Do not order or install equipment until submittals have been reviewed and approved.
- F. Where accepted materials or equipment other than is specified or shown on the Drawings require redesign of structural, architectural, electrical or mechanical features or layouts, such changes shall be made by, or at the expense of the Contractor - all subject to complete review by the Project Manager.
- G. Because of the contingencies involved, review and general acceptance of proposed substitutes shall not relieve the Contractor's responsibility under this Work for ensuring in all respects the suitability of such materials and equipment for the particular Project requirements.

#### 1.11 SHOP DRAWINGS

- A. Prepare shop Drawings of items as required by the Project Manager or by Drawings and Specifications; submit six (6) copies of each to the Project Manager as part of the submittal package, sufficiently in advance of construction, if necessary.
- B. The shop drawings shall be submitted sufficiently in advance of construction to allow time for review and for resubmission, if necessary.
- C. Submit all shop drawings and data at one time for equipment provided under this Section. The complete electrical shop drawings shall be bound in one pamphlet or binder indexed to this Section.
- D. Shop drawing submittals processed are not change orders. The purpose of shop drawing submittals by the Contractor is to demonstrate that the Contractor understands the design concept; he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. If deviations, discrepancies or conflicts between shop Drawings and

Specifications are discovered, either prior to or after shop drawing submittals are processed, the design Drawings and Specifications shall control and shall be followed.

- E. Manufacturers' data and dimension sheets shall be submitted giving all pertinent physical and engineering data including weights, cross-sections and maintenance instructions. Standard items of equipment such as receptacles, switches, plates, etc., which are cataloged items, shall be listed by manufacturer.
- F. Index all submittals and reference to these Specifications.

#### 1.12 COMPLETION DATA

- A. Submit completion data to the Project Manager in acceptable quantity and form before requesting a final inspection. Such submittal shall be corrected, amended, or completed before final acceptance of the Work.
- B. Include Record Drawings, maintenance manuals, and data; test results; control and wiring diagrams.

#### 1.13 CUTTING, PATCHING, AND REPAIRING

- A. Cutting, patching, and framing of wood members to accommodate this Work shall be done by the Contractor and shall be in conformance with Sections 613 and 617 (F) and (K), Title 24, California Code of Regulations. All such cutting, patching and framing shall be approved by the Project Manager.
- B. Do minor miscellaneous cutting, drilling, and patching necessary and normally required at the time of actually installing this Work. Patching shall be of the same materials, workmanship, and finish as the original or surrounding Work to the complete satisfaction of the Project Manager. Comply with Division-1 CUTTING AND PATCHING Section.
- C. Adequately inform other trades of openings and framing requirements for this Work and provide suitable instructions for establishing locations and sizes of openings or sleeves so that these may be provided in the proper location at the proper time. Concrete shall not be cut, except where approved by the Project Manager.

#### 1.14 SIMILARITY OF MATERIALS

- A. Unless specified otherwise, fixtures, fittings, hangers, and respective type features and equipment, of a similar type or having similar operative or functional features, shall be of the same manufacturer throughout the Project.

#### 1.15 MANUFACTURERS' DIRECTIONS

- A. Follow manufacturers' directions and recommendations in all cases where the manufacturers' equipment or articles are used for this Work. Compliance with the manufacturer's direction is a requirement for that product's listing with a recognized test lab.

## 1.16 VERIFICATION OF DIMENSIONS

- A. Scaled and figured dimensions are approximate only. Before proceeding with Work, carefully check and verify dimensions, etc., on architectural Drawings, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.
- B. Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study Drawings and premises in order to determine best methods, exact locations, routes, building obstructions, etc., and install apparatus and equipment in available locations. Install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

## 1.17 IDENTIFICATION OF EQUIPMENT

- A. All electrical equipment shall be labeled, tagged, stamped, or otherwise identified in accordance with the following schedule:
  - 1. Branch Circuit Panelboards:
    - a. Panel identification shall be P-Touch ¾" label.
    - b. Circuit directory shall be a two-column, 8-1/2 x 11" sheet attached to the inside of the door. Each odd numbered circuit shall be in sequence in the left column and the even numbered circuit in the right column (e.g., 1, 3, 5..., 2, 4, 6...). Each circuit shall be identified as to the use and room name(s) or area(s). Confirm room names and/or room numbers with the Project Manager prior to project completion. Circuit breaker identification shall be by permanently installed metal numbers or plastic numbers under acrylic plastic. "Paste-on" numbers will not be accepted. Refer to "Panelboards" section for additional requirements.
  - 2. Distribution Panelboards: Identification shall be with 1" x 4" laminated, white on black, micarta nameplates on each major component, each with name and/or number of unit and other pertinent data as required. Emergency power distribution panels shall be identified with white on red micarta nameplates. Letters shall be no less than 3/8" high.
  - 3. Circuit breakers shall be identified by number and name with 3/4" x 1-1/2" laminated micarta nameplates with 3/16" high letters mounted adjacent to circuit breaker or switch.
  - 4. Miscellaneous equipment (electrical), such as individually mounted safety switches, starters, step-down transformers, pull boxes, junction boxes, etc., shall be identified as required by the use of such equipment with P-Touch labels as required.

5. In general, the installed nameplates, as herein called for shall also clearly indicate its use, area served, circuit identification, voltage and any other useful data.
6. All auxiliary systems, including communications, shall be labeled to indicate function.
7. Motor control and motor control centers shall be labeled with the identification given on drawing schedules.

#### 1.18 ARC FLASH LABELING

- A. All panels, circuit breaker enclosures, switchboards and motor control centers shall be labeled with Arc Flash Warning Stickers.
- B. These labels shall contain the following:
  1. Arc Flash Boundary
  2. Minimum arc rating
  3. Personal Protective Equipment Level, PPE
  4. Shock Hazard Level
  5. Fault Current

#### 1.19 CLOSING IN OF UNREVIEWED WORK

- A. Do not allow or cause any of this Work to be covered up or enclosed until it has been reviewed by the Project Manager. Should any of this Work be enclosed or covered up before such review, uncover the Work and make repairs with such materials as may be necessary to restore the Work and that of the other trades to its original and proper condition at no additional cost to the Owner.

#### 1.20 SAFETY PRECAUTIONS

- A. It is intended that within the scope of this Work during construction and until final acceptance, strict attention be given to matters pertaining to public safety and to safety of the construction workers and complementing personnel; and to other health and building safety requirements as specified and indicated including, but not limited to: Protection of openings in fire-rated construction; clearances from and/or protection of combustibles; proper securement for fixtures, equipment materials; method of performing the Work, operational and safety check of electrical devices, etc.; erection and maintenance of suitable barriers, protective devices, lights and warning signs and adequate provisions for storage and protection of Work, materials and equipment.
- B. It is understood that the responsibility for the proper attention to the above stipulations is included under this Work.

## 1.21 WIRING OF EQUIPMENT FURNISHED UNDER OTHER SECTIONS

- A. All electrical wiring including power wiring and control wiring (except as specified under Automatic Temperature Control), including raceways, wiring, outlet and junction boxes, and labor for installation of the wiring and equipment shall be included in this section of the Specifications.
- B. All control devices, and starters not in motor control centers, for equipment furnished under the Air Conditioning section (except as specified under Automatic Temperature Control paragraph), Plumbing section, Fire Sprinkler or Lawn Sprinkler section are to be furnished under that particular section and installed under this section.
- C. Wiring diagrams complete with all connection details shall be furnished under each respective section.
- D. Coordinate requirements with Division 15 sections prior to ordering and installation.
- E. Comply with requirements of Article 430 of the California Electrical Code.

## 1.22 EXCAVATION AND BACKFILL

- A. Do excavation, trenching, and backfilling required for this Work. Do shoring, pumping, or draining that is necessary to keep the excavations and trenches safe and free from water. Where possible and practical, avoid planted or paved areas, walkways, floors, and other finished surfaces. See CONDUITS Sections for depth of conduits. Remove all excess excavated materials from the site, unless otherwise directed by the Project Manager.
- B. Where required, do cutting and drilling of walls, pavements, walkways, etc., by means of cutting and drilling (coring) machines unless specifically approved otherwise.
- C. Excavation, trenching, and backfill methods and procedures shall be in strict accordance with industry standards and local requirements.
- D. Backfilling shall be done in one-foot layers, with each layer tamped before another layer is added. No stones or coarse lumps shall be laid directly on conduits.

## 1.23 CONCRETE

- A. Where used for structures to be provided under the contract such as bases, etc., concrete work and associated reinforcing shall be as specified under that Division.
- B. See other sections for additional requirements for underground vaults, cable ducts, etc.

## 1.24 PROTECTION OF EXISTING LINES

- A. Exercise special care to avoid damaging and to maintain in operation, all existing utility runs during the construction period. Also avoid damaging existing piping, conduits, or equipment that is to remain, whether or not specifically indicated on the Drawings. Existing utilities, piping, conduits, and equipment may or may not be shown on the Drawings. The Drawings only reflect information intended to suggest the probable extent and possible location of indicated runs and equipment. There may be other runs. There may be other locations. Neither the Owner nor the Project Manager represents that either has any precise knowledge as to either the full extent or exact location of equipment and runs that may fall within the building or Project Site.
- B. Execute excavation and demolition on the Site and in the building with extreme care (by hand or small tools wherever appropriate) and at the sole risk of the Contractor and the workers involved.
- C. Locate all known existing installations before proceeding with construction operations which may cause damage to such installations. The existing installations shall be kept in service where possible and damage to them shall be repaired at no increases in Contract Sum.
- D. If other structures or utilities are encountered, request Project Manager to provide direction on how to proceed with the Work.

#### 1.25 MOUNTING

- A. Provide materials and accessories necessary to properly mount and secure equipment furnished and/or installed under the electrical Work. This includes but is not limited to such items as conduit, outlets, junction boxes, switches, relays, disconnect switches, lighting fixtures, cabinets, and transformers.
- B. Inserts and Anchors shall be:
  - 1. Furnished and installed for support of Work under this Division.
  - 2. Adjustable concrete hanger inserts installed in new concrete work as manufactured by Hilti or as approved.
  - 3. Installed in locations as approved by Project Manager.
  - 4. Expandable lead type anchors installed in existing concrete with minimum surface damage, as manufactured by Hilti.
  - 5. Toggle bolts, or "molly anchors", where installed in concrete block walls.
  - 6. Complete with 3/16" or heavier steel backup plate where used to support heavy items. Through-bolts or backup plate shall be concealed from view, except as otherwise indicated.

- C. Mounting of equipment that is of such size as to be freestanding and that equipment which cannot conveniently be located on walls, such as motor starters, etc., shall be rigidly supported on a framework of galvanized steel angle, Unistrut or as approved.
- D. Furnish and install sleeves for the installation of Work under all sections of this Division. Sleeves through floors, roof and walls shall be as described in conduit section.

#### 1.26 ACCESSIBILITY

- A. Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement conveniently and accessibly throughout the project.
- B. All required access doors or panels in walls and ceilings are to be furnished and installed as part of the Work under this Division.
- C. Provide doors which pierce a fire separation with the same fire rating as the separation.
- D. Refer to "Finish Schedule" for types of walls and ceiling in each area and architectural Drawings for rated wall construction.
- E. Coordinate Work of the various sections to locate specialties requiring accessibility with others to avoid unnecessary duplication of access doors.

#### 1.27 TESTS

- A. Perform electrical tests as required or directed. Provide materials, labor, and equipment necessary for performances of these tests, and at completion of the Work perform a complete "in-service" operation of the entire electrical and power system to show compliance with the Drawings and Specifications. Replace Work showing faults under tests without additional cost to the Owner. Test system voltage at switchboards at completion of Work and provide a written report to the Project Manager.

#### 1.28 EQUIPMENT LISTS AND MAINTENANCE MANUALS

- A. Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manual. The equipment list shall include the following items for every piece of material and equipment supplied under this section of the Specifications.
  - 1. Name, model and manufacturer.
  - 2. Complete parts Drawings and list.
  - 3. Local supply for parts and replacement and telephone number.
  - 4. All tags, inspection slips, instruction packages, etc. removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.

- B. Maintenance manuals shall be furnished for each applicable section of the Specifications, shall be suitably bound with hard covers, and shall include all available manufacturers' operation and maintenance instructions, together with as-built Drawings and lists hereinbefore specified and other diagrams and instructions necessary to properly operate and maintain the equipment. The equipment lists and maintenance manuals shall be submitted in duplicate to Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address and phone number of the General Contractor and all subcontractors involved in any of the Work specified herein. The maintenance manuals shall be finally provided in four copies.

#### 1.29 CLEANING

- A. During construction on a daily basis, and upon completion of the Work, remove from the site all debris and excess materials, tools, and removed items, resulting from this Work. Clean equipment, including lighting fixtures, free of dust, dirt, grease, paint, etc.

#### 1.30 SALVAGE

- A. Deliver salvaged equipment and material deemed salvageable by Project Manager to location designated by Project Manager. Remove other removed material and equipment from site.

#### 1.31 GUARANTEE

- A. Leave the entire installation in complete working order, free from defects in materials, workmanship or finish. Guarantee to repair or replace parts that may develop defects due to faulty materials, equipment, or workmanship within a period of one year after the Work is accepted by the Owner. Also guarantee to repair or replace with like materials, other existing Work in the building damaged from or during the repair of any such defective equipment, materials, or workmanship.

#### 1.32 INSTALLERS QUALIFICATIONS

- A. Installer must have completed an indentured IBEW/NECA apprenticeship program.
- B. Foreman must be a Journeyman Wireman with at least ten years experience in the field.
- C. Submit Installer's Qualifications along with material submittal.

### PART 2 - PRODUCTS AND EXECUTION

#### 2.01 GROUNDING

- A. Grounding shall be executed in accordance with applicable codes and regulations of the State of California, California Electrical Code and local authorities having jurisdiction as well as any additional provisions specified or shown on Drawings.

- B. Grounding bushings shall be used wherever conduits are grounded. Feeder conduits to panels and air conditioners shall have grounding bushings.
- C. Grounding conductors should be located to permit, the shortest and most direct path to ground. Connections shall be readily accessible for inspection and connections shall not be permanently concealed in floors or walls.
- D. Non-current carrying metallic parts of electrical equipment and raceways shall be securely grounded to the common system ground. In all locations, ground conductors shall be run through conduits and shall be securely bonded to the conduit at the entrance and exit. The conduit for the grounding conductors shall be continuous from the point of attachment to cabinets or equipment to the grounding electrode, and shall be securely fastened to the ground clamp fittings.
- E. Ground connections to equipment shall be made with an approved type of exothermic weld or shall be bolted or clamped to equipment or conduit. Sheet metal strap types of ground clamps shall not be used. Contact surfaces shall be thoroughly cleaned and bright before connection is made so as to ensure a good metal to metal contact.
- F. Where nonmetallic conduit is used, ground shall be achieved through use of a separate, green-insulated, copper, code-size, ground conductor included in the conduit.
- G. Bonding of cold water piping system shall be achieved at the service entrance. A copper saddle shall be installed over the copper pipe at the location of the clamp to avoid damage to the pipe.

## 2.02 CONDUIT

- A. Rigid Steel Conduit:
  - 1. Rigid steel conduit shall have zinc coated exterior, zinc or enamel interior, standard weight, zinc coated couplings, locknuts and bushings and shall bear the U.L. label. Rigid conduit shall not be installed underground.
  - 2. Use rigid conduit only for exposed exterior conduit runs, wherever subject to physical damage, or where specifically called for on the Drawings or required by a serving utility.
  - 3. Intermediate metallic conduit (I.M.C.) may be used in lieu of rigid steel conduit.
- B. Electrical Metallic Tubing:
  - 1. Electrical metallic tubing (E.M.T.) shall not be used on this project.
- C. Liquid-tight Flexible Conduit:

1. Liquid-tight flexible conduit shall bear the U.L. label. Fittings for flexible conduit shall be squeeze type. Screw-in connectors and other connectors that decrease the interior diameter of the conduit shall not be used unless specifically approved by the Project Manager.
2. Liquid-tight flexible conduit shall be plastic jacketed moisture and oil resistant with oil and vapor tight connectors.
3. Use liquid-tight flexible conduit for final connection to equipment where vibration may injure direct conduit connection.

D. Plastic Conduit:

1. Plastic conduit shall be rigid polyvinyl chloride (PVC) Underwriter's approval, Schedule 40. Connections and fittings shall be "outside" type assembled in accordance with the recommended methods of the manufacturer.
2. Underground PVC conduit shall be buried a minimum of 24 inches below grade. Where more than two conduits are installed adjacently underground, use factory made conduit spacers.
3. PVC conduit shall be used for underground conduit runs in lieu of wrapped rigid conduit except as noted otherwise on the Drawings or required by the serving utility.
4. Provide a code size ground conductor in each conduit.
5. Only braided polyethylene or similar pull rope shall be used.

E. Installation of Conduit:

1. Underground conduit.
  - a. Keep interior of conduit clean and clear. Clean underground conduits by pulling a mandrel through conduit run followed with a swab before pulling wire.
  - b. Reroute conduit from locations shown on the Drawings where it is necessary to clear obstructions.
  - c. Provide junction or pull boxes where required for pulling conductors due to excessive number of bends or length of conduit runs.
  - d. Bury underground conduit, except those under buildings, a minimum of 24 inches below finished grade. Conduits under roadways shall be a minimum of 36 inches below finished grade. Conduit runs 3/4 inch and smaller in slabs shall be located above vapor barriers. Bury conduit runs larger than 3/4 inch to a minimum depth of 12 inches below floor slabs.

- e. Standard factory ells shall not be used in underground service conduits or other long underground runs. Field bends shall not be flattened or kinked and shall not materially reduce the internal diameter of the conduit. Bends in long underground runs shall be made in long sweeping bends. Do not bend at couplings. Approved conduit bending methods shall be used.
  - f. All conduit runs shall have a code size insulated grounding conductor.
  - g. Properly separate two or more conduits installed underground in a common concrete envelope with approved factory made conduit spacers.
  - h. Locate conduit stub-outs dimensionally from building or curb lines on Record Drawings.
  - i. Pull wires shall be installed in empty conduits including telephone conduits and stub-outs, No. 12 AWG, type "THWN" insulated copper wire or 1/8-inch polyethylene rope shall be used.
  - j. Spare underground conduits shall be sealed with duct plugs that have pull tabs. Duct tape shall not be used to seal unused conduits.
2. Exposed/Concealed Conduit:
- a. Provide secure mounting facilities for conduits. Wire or plumbers tape shall not be used for hanging conduit. Strap shall be factory made of the one hole malleable iron or two hole galvanized clamp type.
  - b. Provide expansion couplings wherever conduits cross expansion joints.
  - c. Run conduit at right angles or parallel to structural members, walls, floors and ceilings. Where several conduits are run together or suspended, they shall be hung on Unistrut trapezes with minimum 3/8-inch rod hangers.
  - d. Cut ends of conduit square and ream to remove burrs or sharp edges. Terminate conduits properly with bushings, locknuts, etc. Terminate one (1) inch and larger conduits with insulated bushings.
  - e. Render conduits projecting through the roofing watertight by proper flashings. Securely fasten a sheet metal cap and tighten bank or storm collar to the conduits. Extend flashing a minimum of six (6) inches in all directions. Coordinate and install roof flashing for conduits to the satisfaction of the Project Manager.
  - f. All conduit runs shall have a code size insulated grounding conductor.

- g. Pull wires shall be installed in empty conduits including telephone conduits and stub-outs, No. 12 AWG, type "THWN" insulated copper wire or 1/8-inch polyethylene rope shall be used.
- h. Flexible conduit connections shall comply with NEC Section 350-22.

### 2.03 OUTLET, JUNCTION AND PULL BOXES

- A. Outlet boxes and junction boxes shall be galvanized one-piece pressed steel, knockout type. The size of each box shall be determined by the number of wires or conduits or size of conduits entering the box, but shall not be less than 4" square and 1-1/2" deep unless otherwise noted. All boxes shall be UL listed.
- B. Minimum box size for data and telephone outlets shall be 4" square and 2-1/8" deep.
- C. Single gang boxes in concrete, for fixture outlets, shall be 4-3/8" octagonal concrete boxes, 2-1/2" deep minimum.
- D. Single gang boxes in concrete, for wiring devices, shall be 3-1/2" deep, 3-3/4" long and 1-7/8" wide.
- E. Single gang outlet boxes installed in concrete or masonry walls shall be a minimum of 3-1/2" deep, 4" long and 2" wide, set flush with the wall and provided with a single gang wall plate.
- F. Install wood blocking for outlet boxes in a rigid, workmanlike manner using new material where wood studs are used. Provide rigid support to avoid twisting of outlet boxes where steel studs are used.
- G. Locknuts shall be used on both sides of conduit connections to box or panel, in addition to bushing. Where a larger size opening occurs than size of conduit, use reducing washers.
- H. Exposed boxes shall be weatherproof, threaded or hub conduit with gasketed conduit cover suitable for device installed or with blank cover plate when conduit is used as a junction box. Conduit wire fill capacity shall not be exceeded.
- I. Recessed weatherproof outlets or junction boxes shall be equipped with neoprene gasketed covers.
- J. Large size junction or pull boxes shall be fabricated from code gauge sheet steel. Where located indoors, finish shall be gray enamel and covers shall be secured with screws. Where exposed to weather, they shall be weatherproof, NEMA 3R, and rain-tight and hot-dip galvanized after fabrication; also, they shall have weatherproof gaskets, flat covers and galvanized iron screws. Provide knockouts and/or threaded hubs as required for the conduit used. Boxes in finished areas shall be prime painted.
- K. Any unused, removed knockouts shall be filled with a K.O. cover.

- L. Provide bonding or grounding from metal conduit terminating in J.B.S. with concentric KO's.

#### 2.04 PLATES AND DEVICE COVERS

- A. Plates for switches, receptacles, telephone and blank outlets shall be stainless steel, Hubbell 302/304 alloy or P & S "S" line, unless otherwise noted. Plates shall be engraved per Drawings or as covered under the Article of this Specification titled MARKING.

#### 2.05 RECEPTACLES

- A. Duplex convenience outlets shall be specification grade, backwire, three wire, NEMA #5-20R, self-grounding type, 20 ampere, 125 volt parallel slots, polarized, in white. Additional receptacles shall be as indicated on the Drawings. Receptacles shall be Hubbell #5253W.
- B. Receptacles indicated as weather-resistant shall have lift cover plates that are weather-resistant "while in use" Taymac Corp. or equal. All exterior receptacles shall be mounted four feet above finished grade to the bottom of the outlet box.
- C. Ground fault current interrupter outlets shall be self-testing, Hubbell # GFR5352WST.

#### 2.06 LIGHTING SWITCHES

- A. Line voltage lighting switches shall be specification grade, quiet type, 20 amp. 120/277 volt A.C. white handled, unless otherwise noted. Switches shall be Hubbell #CS1221W.

#### 2.07 WIRE AND CABLE

- A. 600 Volt Conductors:
  - 1. Conductors shall be copper and delivered to the site in their original, unbroken packages plainly marked or tagged with U.L. label, size, kind, insulation, name of manufacturer and trade name of the wire.
  - 2. Type "THWN", 600 volt insulation for damp or wet locations or on boilers and furnaces and their controls.
  - 3. Type "THHN" 600 volt insulation shall be used in other locations unless noted.
  - 4. Minimum size conductor shall be #12.
  - 5. Conductors shall be stranded.
  - 6. Ground conductors shall be bare copper or have green insulation.
- B. Installation:

1. Conductors shall be continuous between outlets or junction boxes and no splices shall be made except in outlet boxes, pull boxes, panelboard gutters or handholes.
  2. Joints, splices and taps No. 10 or smaller (including fixture pigtails) shall be connected with "floating spring" type connectors. No. 8 and larger shall be connected with solderless connectors of 100% electrolytic copper. Split-bolt connectors are not acceptable.
  3. Tighten pressure type lugs on panels and equipment, and then retighten 24 hours or more later after energizing. Provide written report of torque values on lugs.
  4. Oil or grease shall not be used when pulling conductors. Use U.L. approved cable lubrication only.
  5. Lace or train conductors neatly in panels, cabinets and equipment. Use plastic wire ties to route conductors at edge of enclosure away from overcurrent devices.
  6. Branch circuits shall be color coded in compliance with Section 210-5 of the California Electrical Code. Colored tape is not acceptable.
  7. All wiring, both line and low voltage, shall be installed in conduit unless otherwise noted.
- C. Tag:
1. Branch circuits shall be left tagged with circuit numbers in gutters and junction boxes where unused circuits terminate.
  2. Feeder conductors shall be tagged as phase "A" or "B" or "C".
  3. The method of tagging shall be with adhesive preprinted tape numbered or lettered wrap around tags. Colored tape is not acceptable.
  4. Tagging shall be applied after wire is installed in conduit.
  5. Feeders in panel or equipment shall be tagged by phase letter in each panel or equipment.
  6. Where it is impractical to use printed markers on certain wires or cables, use blank tape with identification marked thereon with indelible pencil.
- D. Color Coding for Phase Identification: Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

| <u>208y/120Volts</u> | <u>Phase</u> | <u>480y/277Volts</u> |
|----------------------|--------------|----------------------|
| Black                | A            | Yellow               |
| Red                  | B            | Brown                |
| Blue                 | C            | Orange               |

White  
Green

Neutral  
Ground

Gray  
Green

## 2.08 DISCONNECT SWITCHES

- A. Non-fusible or fusible as shown on the Drawings, heavy duty, 250 or 600 volts as required, NEMA Type 3R enclosure.

## 2.09 LIGHTING FIXTURES

- A. Lighting fixtures shall be of manufacture and type as specified in the Fixture Schedule, and shall have all parts and fittings necessary to completely and properly install the fixture. Fixtures of the same type shall be of one manufacturer and of identical finish and material.
- B. Lighting fixtures shall bear Underwriter's Laboratories labels.
- C. Fixtures shall be furnished and installed as indicated on the Drawings, including hangers, glassware, auxiliary equipment, sockets, lamps, connectors for continuous installation, etc.
- D. Each fixture shall be wired with conductors suitable for the voltage, current and temperature to which the conductors will be subjected.
- E. If excessive ballast hum develops within 12 months after installation, the condition shall be corrected at no charge to the Owner. Flickering of the lamps or blacking of the lamp ends within 12 months shall also be corrected at no charge to the Owner.
- F. Proper lamps of type, size, color temperature and wattage indicated shall be furnished and installed in each fixture and shall be manufactured by General Electric, Phillips, Sylvania, or Venture. The Contractor shall replace lamps which have been burned out prior to final completion. Clean dust, dirt, fingerprints and grease from fixtures before final completion.
- I. Provide certified ballasts identified in fixture schedule.
- J. Fluorescent fixtures shall have ballast disconnect connectors.

## 2.10 PANELBOARDS

- A. Section Includes:
  - 1. Power Distribution Panelboard: Furnish and install distribution panelboard(s) as specified herein and where shown on the associated schedules on Drawings.
  - 2. Lighting and Appliance Panelboard: Furnish and install lighting and appliance panelboard(s) as specified herein and where shown on the associated schedules on Drawings.

- B. References: The panelboard(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following Specifications.
1. NEMA PB-1 - Panelboards.
  2. NEMA PB-1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
  3. NEMA AB 1 - Molded Case Circuit Breakers.
  4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
  5. UL 50 - Enclosures for Electrical Equipment.
  6. UL 67 - Panelboards.
  7. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures.
- C. Power Distribution Panelboards: (Square D I-Line, no equal)
1. Interior:
    - a. Shall be rated 600 VAC. Continuous main current ratings as indicated on associated schedules on Drawings not to exceed 1200 amperes maximum. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67.
    - b. Provide UL Listed short circuit current ratings (SCCR) as indicated on the associated schedules on Drawings not to exceed the lowest interrupting capacity rating of any circuit breaker installed with a maximum of 200,000 rms symmetrical amperes. Main lug and main breaker panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
    - c. The panelboard interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.
    - d. The bussing shall be fully rated with sequentially phased branch distribution. Panelboard bussing rated 100 through 600 amperes shall be plated copper. Bussing rated 800 amperes and above shall be plated copper. The entire interleaved assembly shall be contained between two (2) U-shaped steel channels, permanently secured to a galvanized steel-mounting pan by fasteners employing the use of a tamper-resistant warning label.

- e. Interior trim shall be of dead-front construction to shield user from all energized parts. Main circuit breakers through 800 amperes shall be vertically mounted. Main circuit breaker and main lug interiors shall be field convertible for top or bottom incoming feed.
  - f. Equipment ground bar shall be [insulated] [bonded.] Ground bar shall be copper. Solid neutral shall be equipped with a full capacity grounding strap for service entrance applications. Gutter-mounted neutral will not be acceptable.
  - g. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label, and Short Circuit Current Rating shall be provided. Leveling provisions shall be provided for flush mounted applications.
2. Molded Case Circuit Breakers - Mains and Branches:
- a. Common Characteristics:
    - 1) Circuit breakers shall be constructed in accordance with the following standards:  
UL 489 Federal Specification W-C-375B/GEN  
NEMA AB1 CSA 22.2, No. 5-M91  
IEC 157-1 BS 4752
    - 2) Circuit breakers shall be constructed using glass reinforced polyester insulating material providing superior dielectric strength. Current-carrying components shall be completely isolated from the handle and the accessory mounting area.
    - 3) Circuit breakers shall have an overcenter, trip-free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
    - 4) Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
    - 5) Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
    - 6) Breaker faceplate shall indicate rated ampacity. Breaker faceplate shall indicate UL and IEC certification standards with applicable voltage systems and corresponding AIR ratings.

- 7) Circuit breakers shall be factory sealed and shall have a date code on the face of the circuit breaker. Poles shall be labeled with respective phase designations.
  - 8) Lugs shall be UL Listed to accept solid or stranded copper conductors only. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16]. Lug body shall be bolted in place; snap-in designs are not acceptable.
    - (a) Circuit breakers shall be UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Auxiliary Switch, Alarm Switch, Ground Fault Shunt Trip, Electrical Operators, Cylinder Locks, Mechanical Lugs Kits, Compression Lugs Kits, and Handle Accessories.
  - 9) Two- and three-pole circuit breakers shall have an internal common trip crossbar to provide simultaneous tripping. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the breaker, which allows the user to simultaneously select the desired trip level of all poles.
  - 10) Standard circuit breakers up to 250 amperes at 600 VAC shall be UL Listed with HACR ratings.
  - 11) Enclosures:
    - (a) Type 3R, 3S, 5 and 12:
      1. Enclosures shall be constructed in accordance with UL 50 requirements. Endwalls shall be welded and sealed. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
      2. All doors shall be gasketed and be equipped with a tumbler type vault lock and two (2) additional trunk type latches. A clear plastic directory cardholder shall be mounted on the inside of door. All lock assemblies shall be keyed alike. Two (2) keys shall be provided with each lock.
      3. Maximum enclosure dimensions shall not exceed 42 in. wide and 12.95 in. deep.
- D. Lighting and Appliance Panelboard: (Square D NQOD, no equal)
1. Interior:

- a. Shall be rated for 240 VAC/48 VDC maximum. Continuous main current ratings, as indicated on associated schedules, not to exceed 600 amperes maximum.
  - b. Minimum short circuit current rating: As indicated on schedules in rms symmetrical amperes at 240 VAC.
  - c. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be copper. Bussing rated for 600 amperes shall be copper as standard construction. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and G.
  - d. All current-carrying parts shall be insulated from ground and phase-to-phase by Noryl high dielectric strength thermoplastic or equivalent.
  - e. Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length.
  - f. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twistouts covering unused mounting space.
  - g. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
  - h. Interiors shall be field converted for top or bottom incoming feed. Main and sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
2. Main Circuit Breaker:
- a. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.
  - b. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip

adjustment located on the front of the circuit breaker, which allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.

- c. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
  - d. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
  - e. Lugs shall be UL Listed to accept solid or stranded copper conductors only. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Lug body shall be bolted in place; snap-in designs are not acceptable.
3. Branch Circuit Breakers:
- a. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the panelboard schedules.
  - b. Molded case branch circuit breakers shall have bolt-on type bus connectors.
  - c. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
  - d. There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF.
  - e. The exposed faceplates of all branch circuit breakers shall be flush with one another.
  - f. Lugs shall be UL Listed to accept solid or stranded copper conductors only. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16.
4. Enclosures:
- a. Type 3R, 3S, 5, and 12:
    - 1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

- 2) All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional trunk type latches. All lock assemblies shall be keyed alike. Two (2) keys shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
- 3) Maximum enclosure dimensions shall not exceed 20 in. wide and 6.5 in. deep.

#### 2.12 Meter/Main

- A. The meter/main shall be UL and EUSERC rated. The metering section shall comply with Southern California Edison (SCE) requirements. The bus size and circuit breaker trip settings shall be as indicated on the Drawings. Circuit breakers shall be provided with means for padlocking in the "Off" position. The enclosure shall have facilities for the power company's meters and test apparatus. Sequence of metering shall be as required by the serving utility company. It shall be finished in baked grey enamel. Bussing shall be copper. Ground bus and solid neutral shall be provided. Provide plastic laminated nameplate. Support switchboard in accordance with manufacturer's requirements. Provide all required seismic bracing.
- B. Main circuit breaker shall be listed and marked for service entrance.
- C. Circuit breakers shall be bolt-on type, plastic molded case, trip free with quick-make, quick break operating mechanism.
- D. Provide plastic, engraved, laminated nameplates for switchboard identification as well as each circuit breaker. Provide a separate plastic, engraved, laminated nameplate with the meter's address.

END OF SECTION