Jacobs

ADDENDUM NO. 2 Date: February 26, 2026
TO THE CONTRACT DOCUMENTS Project No.: D3755100

for the construction of
WRIGHT SMITH JR WWTP ELECTRICAL, I & C AND HVAC MODIFICATIONS PROJECT
MOBILE AREA WATER AND SEWER SERVICES (MAWSS)
MOBILE, AL

To All Planholders and/or Prospective Bidders:

The following changes, additions, and/or deletions are hereby made a part of the Contract Documents for the construction of Wright Smith Jr WWTP Electrical, I & C and HVAC Modifications Project dated January 2026 as fully and completely as if the same were fully set forth therein:

A. **PART 1—MAWSS STANDARD SPECIFICATIONS**

1. No Changes

B. **PART 2—TECHNICAL SPECIFICATIONS**

1. The following specification sections are added and are issued as herewith attached:

   a. 04 21 13.13 Masonry Veneer
   b. 04 22 00B Concrete Unit Masonry
   c. 07 92 00 Joint Sealants
   d. 26 08 00 Commissioning of Electrical Systems

2. Section 09 90 00 shall be amended to System No. 4 as the prescribed painting system for piping as associated with the influent pump replacement. System No. 4 shall be in accordance with the following table:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Epoxy Primer—Ferrous Metal	1 coat, 2.5 MDFT
	High Build Epoxy	1 coat, 4 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

3. Specification Section 26 14 13 is revised to add the language as herewith issued in the file 26_14_13B_Switchboards - ATO Supplement Add2. This file also replaces the language in paragraph 2.13.

4. Specification Section 26 14 13.2 Paragraph 2.05.D shall be revised to require a 3000A bus rating

5. Specification Section 26 24 19 Paragraph 2.03.A.4 is hereby deleted and the reference in Paragraph 2.03.H.1.c to starters is deleted.

6. Specification Section 44 42 56.04 Paragraph 2.05.B shall be ADDED as follows: "All internal wetted parts including volute assembly, impeller and discharge connection shall receive a ceramic-epoxy coating as per below. 1. Belzona®1321 (Ceramic S -Metal) (Minimum 24 dry mils thickness) shall be applied blue topcoat and gray basecoat (to ensure successful overlap) by brush, applicator, or spray at a typical thickness of 15 mils per coat. The first coat shall not be left more than 24 hours before overcoating with the second coat. Evidence of basecoat shall not be identifiable upon completion."

C. **PART 3—<u>DRAWINGS</u>**

1. The following Drawings are added and are issued as herewith attached:

a. 05-E-2001
b. 05-E-2002
c. 05-E-6001
d. 05-E-6002
e. 05-E-6002
f. 05-E-6003
g. 05-E-6004

2. Drawings 06-E-6001 is revised to indicate the feeders from the switchboard to MCC 1 /MCC2 shall be 800E.

3. Drawing 08-N-7002 is reissued with changes as clouded.

4. Ref Dwg 20-D-2001 – As a Contractor's alternate to the modification of the existing concrete pedestal, the required replacement pump may be supplied with a configuration to accommodate the existing pedestal geometry without modification provided the piping geometry is modified to coordinate the provided pump geometry with the existing influent piping invert elevation and the discharge alignment. Such accommodation would include a flanged carbon steel pipe spool between the pump and the influent 90-degree bend. The length of that spool shall be field verified prior to its production. This geometry will still require adjustment of the horizontal length of the influent pipe and the vertical length of the discharge pipe. For the attachment of the pump to the pedestal, the existing anchor bolts shall be cut flush with the pedestal top and new anchor bolts installed. The six new anchor bolts shall be HAS-R 316SS 5/8" x 12" Hilti anchors with 6" embedment installed per Hilti's recommendations. Pump installation shall include roughening and cleaning of the existing concrete pedestal's mating surface, application of an acrylic-based bonding agent and epoxy-grout installation between the pump base plate and the pedestal.

D. **PART 5 - <u>QUESTIONS AND RESPONSES (Q and R)</u>:**

1. Q: Ref Spec 26 05 05 and/or DWG 14 - Does new wire sizing designations include provisions for voltage drop of extended wiring?

R: Yes.

2. Q: Ref Spec 26 05 05 and/or DWG 61 - Will Alabama Power demo the existing MV primary wiring to the existing service transformer?

   R: Contractor shall remove the conductors downline form the existing transformer as loads are transferred to the new feeds. Transformer and MV power feeds shall be abandoned in place.

3. Q: Ref Spec 26 05 05 and/or DWG 36 - Will Alabama Power install the new medium voltage primary service and transformer at no cost to contractor?

   R: Per Drawing 05-C-2002, the site plan includes a transformer pad on the south side of the Operations Electrical Building. Conduits from this pad to the service drop point are required per Drawing 05-E-2001 as issued with Addendum 2. Contractor shall coordinate with Alabama Power for the specific details of the required conduit terminations and transformer pad and also Alabama Power's installation of the transformer and feed conductors.

4. Q: Ref Spec 26 41 00 and/or DWG 99 & 116 - Will new precast buildings 58 and 62 require lightening protection?

   R: Lightning protection of Buildings 58 and 62 is required per Specification Section 26 41 00 Facility Lightning Protection.

5. Q: Ref Spec 26 05 70 - Will all existing equipment be required to be included in electrical systems analysis?

   R: Yes.

6. Q: Ref Spec 26 05 7 and/or DWG 81 - Q: Will temporary MCC to be purchased by contractor in building 56 be required to have a means of disconnect in the room?

   R: Yes. A service entrance rated disconnecting means is required.

7. Q: Ref Spec 44 42 56.04 and/or DWG 46 - Q: Will influent Pump #5 require the same 400A NEMA4 stainless disconnect and terminal block configuration to match existing pumps? Drawing do not show this as a disconnect.

   R: The terminal junction boxes for pumps 1, 2, 3, and 5 and the disconnect for pump 4 as indicated on Drawing 20-E-2001 shall be reused

8. Q: Ref Spec 26 24 16 and/or DWG 41-45 - Q: Panel schedules show panels in conditioned spaces to be NEMA3R. Can panels in conditioned spaces be NEMA 1 surface mount?

   R: NEMA 1 will be acceptable in conditioned spaces (e.g. 58 - operations electrical building).

9. Q: Ref Spec 26 24 19 and/or DWG 32-40 - Q: Spec 26 24 19, page 4 Paragraph 2.2g requires new MCCs to be anchored by 316 stainless steel bolts sized by a licensed structural engineer registered in Alabama. Will this be required?

   R: Yes, anchorage design in accordance with Section 01 88 15, Anchorage and Bracing is required.

10. Q: Ref Spec 40 90 01 - Q: Will ACS provide project loop sheets?

    R: Yes, as described in 40 90 00.

11. Q: Ref DWG 38 - Q: Will new MCC 3 / 4 require a comms connection?

    R: No.

12. Q: Ref Spec div 26 and/or DWG 62 - Q: If existing enclosures or switchgear is modified and used for marshalling, will UL listing recertification of the marshalling enclosure be required?

    R: UL re-certification will not be required for the converted RTU-2 or RTU-3 panels. RTU-2 converts to 52-TJB-1 and RTU-3 converts to 55-TJB-1.

13. Q: Is the intent to use new FM-200 or the latest version of clean agent suppression?

    R: The client direction is to reuse whatever components of the existing FM-200 systems that make sense. So, if any parts can't be reused or are not part of the existing systems, Contractor shall provide the remaining necessary components to result in complete and operational FM-200 systems.

14. Q: Ref Spec 21 24 00 and/or DWG 97 & 115 - Q: Is the bid package intent to have clean agent suppression in 1) Building 58, 2) Building 62 server room, and 3) Building 62?

    R: Yes

15. Q: Ref Spec 13 34 23 and/or DWG 110 - Q: Can the door of precast building 62 be moved to the center of the wall? Wall section cannot be shipped with opening close to the end.

    R: Door 62101A may be moved towards the wall center by up to 2' provided it is changed to a left-hand -reverse hand and any conflicting components are relocated as coordinated through shop drawing submittals prior to installation or conduit rough-in.

16. Q: Ref Spec 26 29 23 and/or DWG 46-47 - Q: Is Allen Bradley or ABB an approved vendor for adjustable frequency drives?

    R: No. All allowed manufacturers are as listed in the specifications.

17. Q: Ref DWG 61 - Q: Who owns the current service transformer? Who owns the over head power distribution line within the plant?

    R: MAWSS owns the Transformer. Power pole ownership is unclear. MAWSS will determine that and this response will be provided as available

18. Q: Ref Spec DIV 31 And/or DWG 17 - Q: Can removed existing soils be disposed onsite or will they be required to be removed?

    R: All surplus soils shall be disposed of off site by the Contractor

19. Q: Ref Spec 26 14 13 And/or DWG 36 - Q: Define times for owner training of main switchboard vendor support.

    R: In compliance with Specification 26 14 13 Paragraph 3.02.B. FYI 3.02.B, MAWSS shall be provided with two training sessions of a minimum 4-hours each on a successive Thursday and Friday.

20. Q: Will there be time or access restrictions for certain rooms or offices during construction?

    R: Per drawing 54-H-2001, General Note 13, "Owner will turn over building to Contractor for a period of 2 months for construction activity." Additionally, all work within the building shall be performed within that two-month period. If the bid alternate for the full rewiring of this building is accepted, the period shall be extended to three continuous months.

21. Q: Ref Spec 26 14 13.2, Paragraph 10.G - The PM5563 meters have dual Ethernet ports, and has the following native protocols included - Modbus TCP/IP, BACnet/IP, EtherNet/IP, DNP3, HTTP/HTTPS, FTP/FTPS, SNMP, SNTP, SMTP, DHCP/BOOTp. ProfiNET is not available, and will require the use of a gateway. Since no network is provided internal to the switchboard, this gateway is NOT included. Is this acceptable?

    R: ProfiNET gateways will not be required; communications between the power meters and SCADA/PLC may be achieved via Ethernet/IP.

22. Q: Ref Spec 26 05 05, There's no accessibility between the starter contactor and Tesys T overload relay for the remote PFCC connection. Please clarify.

    R: The PFCCs are depicted as represented in the record documents. It's our understanding that they are connected parallel to the motor: between the starter contact and overload relay. If the new contact output does not include spare contacts to facilitate this, provide an additional terminal block to split the load connection as such.

23. Q: Ref Spec 26 14 13 and Dwg 06-E-6001, it is unclear if the MSB on sheet 06-E-6001 is a Switchboard or LV Switchgear. Details show LV Switchgear and there no specification for LV Switchgear, only Switchboards. Please clarify if the MSB is to be a Switchboard or LV Switchgear.

    R: This will be an LV Switchboard.

All Bidders shall acknowledge receipt and acceptance of Addendum No. 2 in the Bid Form or by submitting the Addendum with the bid package. Bid Forms submitted without acknowledgment or without this Addendum will be considered in nonconformance.
Jacobs.

David Carr, P.E.
Project Manager

Appended hereto and part of Addendum No. 2:

Specifications:
04 21 13.13 Masonry Veneer
04 22 00B Concrete Unit Masonry
07 92 00 Joint Sealants
26 08 00 Commissioning of Electrical Systems
26_14_13B_Switchboards - ATO Supplement

Drawings:
05-E-2001, 05-E-2002, 05-E-6001, 05-E-6002, 05-E-6003, 05-E-6004, 08-N-7002

END OF ADDENDUM

SECTION 04 21 13.13
MASONRY VENEER

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   c. B370, Standard Specification for Copper Sheet and Strip for Building Construction.
   d. C90, Standard Specification for Loadbearing Concrete Masonry Units.
   e. C91, Standard Specification for Masonry Cement.
   f. C126, Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
   g. C144, Standard Specification for Aggregate for Masonry Mortar.
   h. C150/C150M, Standard Specification for Portland Cement.
   i. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
   j. C216, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
   k. C270, Standard Specification for Mortar for Unit Masonry.
   l. C652, Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale).
   m. C979/C979M, Standard Specification for Pigments for Integrally Colored Concrete.
   n. D1056, Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
   o. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
   p. E2178, Standard Test Method for Air Permeance of Building Materials.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Manufacturer's product information for each different item specified.
   b. Mix designs for mortar.
   c. Details for cast stone units and special brick shapes and assemblies.
2. Samples:
   a. Full-size units for each different exposed masonry unit required showing full range of exposed color, texture, and dimensions to be expected in completed construction. Match existing buildings in type, size, color and texture.
      1) Include size variation data verifying that actual range of sizes for brick falls within ASTM C216 dimension tolerances for brick where modular dimensioning is indicated.
   b. Colored masonry mortar Samples for each color required showing full range of colors expected in finished construction. Label Samples to indicate type and amount of colorant used.
   c. Stone and cast stone Samples not less than 12 inches in length showing full range of colors and textures expected in finished construction.
   d. Cast stone copping cap Shop Drawings showing:
      1) Size and location of precast pieces.
      2) Locations and sizes of connection slots required for split tail and L anchors.
      3) Types of anchors and fastener, with locations used to anchor precast coping pieces in place.
   e. Masonry Mat: Submit 2 samples 6 inches by 6 inches in size with manufacturer's product datasheet with labeled thickness to be used.
   f. Weep: Submit 2 sample weep vents, actual size and color and manufacturer's data sheet.

B. Informational Submittals:

1. Experience record of mortar color pigment proposed for use.
2. Manufacturer's certificate of compliance for masonry units specified herein.
3. Method and materials for removal of efflorescence.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: For masonry construction meet requirements of the International Building Code including local and State amendments and as supplemented by these Specifications.

B. Mockups: Lay up a Sample panel for each type of masonry at the Site including reinforcing, air and water barrier, insulation, and veneer ties. Show bond pattern and method of finishing joints. Make Sample panels 8 feet high and 8 feet long, including base of wall flashing and one masonry control joint. Provide precast coping cap and flashing as specified. Provide representation of each color and shale pf brick and split face CMU veneer to be used. Remove mockup after acceptance of permanent masonry Work. Mockup may be a part of permanent construction. Acceptable Sample panel serves as a basis of color, texture, pattern, and workmanship for acceptance of the permanent construction.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:

1. Store all masonry materials off ground and protected from precipitation.
2. Protect veneer materials from mud splatters and staining.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Temperature: Do not lay masonry when ambient temperature is below 32 degrees F on a rising temperature or below 40 degrees F on a falling temperature, or when there is a probability of such conditions occurring within 48 hours, unless express approval of Engineer is obtained. In such case, make special provisions for heating materials and protecting finished Work. Protect masonry against freezing for a minimum of 48 hours after being laid. Protect tops of walls from precipitation at all times. Cover with waterproof paper when rain or snow is imminent and the Work is discontinued.

B. Humidity: Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 99 degrees F (37 degrees C) in the shade with relative humidity less than 50 percent.

PART 2 PRODUCTS

2.01 MASONRY UNITS

A. Color, Texture, and Pattern: Match submitted Samples matching existing building materials and approved by Engineer.

B. Concrete Masonry Veneer:

1. General:
   a. Furnish special shapes for corners, jambs, lintels, and other areas shown or required.
   b. Special units shall match texture of standard units.
   c. Where units are placed so end of unit is exposed, such as at a corner or at a wall opening, exposed end of that block shall have surface to match texture of sides of other units.
   d. Furnish sound, dry, clean units free of cracks and chips.
   e. All veneer block to have integral water repellency.
2. Textured Concrete Masonry Unit Veneer (TCMUV-2):
   a. Textured units to match existing buildings.
   b. Nominal Size: 16 inches long by 8 inches high by 4 inches thick. Furnish special shapes in sizes as required.
   c. Split-face texture at exposed faces and ends.
   d. Color of Units: To match existing buildings.
3. Existing building product: Graselli Concrete Products Co. Inc., Cliffside Crème.

2.02 FACING BRICK

A. The brick veneer is to match size, color, pattern and grout color of the existing building brick veneer. The proposed veneer brick to be the following:

1. Facing Brick: ASTM C2l6, Grade SW. Type FBX
   a. Minimum compressive strength for individual brick: 2,500 psi.
   b. Size: Match existing in size and color.
2. Existing Building Brick Products:
   a. Type “A” Belden Brick Company: Dutch Gray Velour.
   b. Type “B” Belden Brick Company: No. 503-505 Smooth.

2.03 CAST STONE AND CAST STONE COPING CAP

A. The cast stone and coping cap are to match size, color, pattern and grout color of the existing building stone cap and trim. The proposed cast stone to be the following:

1. Homogeneous, manufactured from portland cement concrete, precast, and of same composition throughout each piece. Use of selected aggregates for faces only is expressly prohibited.
2. Sound and perfect, with sharp and true corners.
3. Furnish with holes, regrets, rebates, and other features as required by the design and for installation.
4. Aggregate: Known durability; proportioned to produce maximum density.
5. Properties:
   a. Minimum Compressive Strength: 7,000 psi.
   b. Maximum Average Water Absorption: 5 percent.
6. Reinforcing: By manufacturer as required for strength of unit.
7. Properly cure prior to delivery.
8. Integral Color: Match existing building.
9. All cast stone to have integral water repellency.
   Coating: Coat each stone with coating per specification Section 07 19 00, Water Repellants.

B. The cast stone coping cap pieces are to be made of the largest size possible to eliminate the number of joints while still facilitating installation. The proposed cast stone to be the following:

1. Cut or form slots to receive stainless steel split tail stone anchors. Size and placement to be coordinated with type of anchors used. 1-1/4 inches deep minimum. Slots in end pieces of coping cap to be located in the lower side of the cast stone. The slot should allow the vertical leg of the starter anchor to extend a minimum of 1 inch into the coping cap.
2. Center slot location over CMU fully grouted top course located below.

2.04 MORTAR MATERIALS

A. Masonry Cement: ASTM C91, low alkali content (0.03 percent maximum).

B. Portland Cement: ASTM C150, Type I, low alkali content (0.60 percent maximum).

C. Lime: ASTM C207, Type S.

D. Mortar: ASTM C270, Type S. Consisting of one part portland cement, from 1/4 part to 1/2 part lime putty or hydrated lime, and clean well-graded sand in the proportion of three times the sum of the cementitious material; or 1/2 part portland cement, one part masonry cement, and clean well-graded sand in the proportion of three times the sum of the cementitious material.

1. If color is added, add in a consistent manner to provide final uniformity.
2. No antifreeze liquid, salts, or other substances are allowed to lower freezing point. No calcium chloride is allowed in mortar.

E. Mortar Color:

1. Pure, concentrated mineral, pigment specially processed for mixing in to mortar; ASTM C979.
2. Manufacturer and Product:
   a. Davis Colors, True Tone Cement Colors.
   b. Solomon Colors, Mortar Colors.
3. Color: Match existing Building.

F. Sand: ASTM C144, in addition not less than 5 percent passes the No. 100 sieve.

G. Water: Fresh, clean, and free of deleterious acids, alkalies, chlorides, and organic materials.

2.05 MORTAR PREPARATION

A. Place one-half the water and aggregate in operating mixer; add cement; add remaining aggregate and water and mix for at least 2 minutes. Add lime and continue mixing as long as needed to secure a uniform mass, but no less than 3 minutes after the addition of lime. Time the addition of admixture in strict accordance with manufacturer’s instructions and the procedure used for adding it to the mix shall provide good dispersion.

B. Mix mortar in machine with mixing drums clean and free of debris and dried mortar. Use mortar before the initial setting of the cement has taken place. Do not retemper mortar in which the cement has started to set.

C. Retemper mortar boards by adding water within a basin formed with the mortar and the mortar reworked into the water. Dashing or pouring water over mortar and retempering of harsh, nonplastic mortar is not permitted.

D. Where color tinting of mortar is required, add sufficient lime-proof color-fast mineral pigment to mortar.

2.06 MASONRY CONTROL JOINTS

A. ASTM D1056, closed cell neoprene sponge, 3 inches wide by 3/8 inch thick.

2.07 AIR AND WATER BARRIER

A. Air and water barrier, fluid applied, one component, vapor permeable membrane, cures on masonry or concrete surfaces to form a resilient, monolithic, fully-bonded elastomeric sheet, 40 mils minimum dry thickness, meeting requirements of ASTM E2178 for air permeance.

B. Manufacturers and Products:

1. Grace, Perma-A-Barrier Liquid VP.
2. Hohmann and Barnard, Inc.; Textroflash Liquid VP.

2.08 THROUGH-WALL FLASHING

A. See Section 07 62 00, Sheet Metal Flashing and Trim; or

B. ASTM B370. Copper, 16 ounces, 0.0216-inch-thick, rib-bond cold-rolled with uniform, matching, pattern deformations, embossed to provide a mechanical bond in all directions within the mortar bed.

2.09 MASONRY ACCESSORIES AND ANCILLARY MATERIALS

A. Manufacturers, unless noted otherwise:

1. Hohmann and Barnard, Inc.
2. Heckmann Building Products.

B. Masonry accessories are, but are not limited to:

1. Horizontal Joint Reinforcement:
   a. Two parallel No. 9 wires, galvanized in accordance with ASTM A153/A153M, weld connected to No. 9 perpendicular cross wire at 15 inches on center.
   b. Reinforcement: Clean and free from loose rust, scale, and any coatings that reduce bond.
   c. Furnish special manufactured corner and wall intersection pieces at these locations.
   d. Seismic condition requires: 9 gauge or 3/16 inch continuous wire. (seismic dovetail anchor, if required).
   e. Engage or enclose joint reinforcement with anchor tie.
   f. Manufacturer and Product: Dur-O-Wal, Inc., Arlington Heights, IL.
   g. Other Manufacturers: Hohmann and Bernard Inc., Hauppage, NY.

2. Adjustable Anchor Ties:
   a. 16-gauge stainless steel plate with slot.
   b. Anchor Tie: 12-gauge stainless steel pintle plate capable of being inserted into slotted plate.
   c. Engage or enclose No. 9 gauge wire joint reinforcing with anchor tie.
   d. Manufacturer and Product: Dur-O-Wal, Inc., Arlington Heights, IL; seismic Ladur-eye.
3. Masonry Mat and Weep System:
   a. Masonry drainage mat and weep system for air space maintenance, mortar dropping prevention and drainage system.
   b. Fluid conducting, non-absorbent, mold and mildew resistant polymer mesh consisting of 100 percent recycled plastic with binder.
   c. 1-3/4 inch thick allowing no more than 3/8-inch tolerance within air space to solid vertical surfaces.
   d. Manufacturer: CavClear.
4. Reglets for Masonry:
   a. Manufacturers and Products:
      1) Superior Concrete Accessories, Franklin Park, IL; Superior Cushion Lock reglets Type B-3.
      2) Fry Reglet Corp., Glendale, CA; Fry Springlok Type MA.
5. Split Tail and L Stone Anchors:
   a. Product to meet FY=45,000 p.s.i. (ASTM A666).
   b. Finish: Type 304 stainless steel.
   c. Thickness: 3/16 inch thick.
   d. Length: 3 inches or as required for proper attachment.
   e. Split bend length 1 inch minimum.
   f. Bend length: 2 inches.
   g. Size of attachment hole: 5/16 inch.
   h. Manufacturers and products:
      1) Masonry Accessories, Inc., Orlando FL, Split tail anchor/ L anchor.
      2) Heckmann Building Products, Norwalk CT. Split-Bend anchor 274/ L anchor with slot 342.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of masonry veneer.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 AIR AND WATER BARRIER

A. Cleaning of Substrate:

1. Thoroughly clean surfaces to receive membrane following membrane manufacturer's recommendations.
2. Treat as necessary to remove laitance, loose material on surface, grease, oil, and other contaminants that will affect bond of the membrane.
3. Vacuum clean or clear water wash surfaces and allow to dry completely.

B. Fill voids and control joints with sealant and overcoat with nonflow membrane material. Fill or coat visible shrinkage cracks to minimum 2 inches either side of crack.

C. Follow manufacturer's directions for application including limitations because of weather, temperature, and concrete cure time. Apply by brush or spray following manufacturer's recommended coverage and coating rates.

3.03 GENERAL INSTALLATION

A. Matching Existing Masonry: Match coursing, bonding, color, and texture of new masonry with existing masonry. Proposed material to be used to be submitted as part of submittal for approval.

B. Provide or cut special shapes for corners, jambs, lintels, and other areas as shown or as required. Match color and texture of standard units.

C. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

D. Matching Existing Masonry: Match coursing, bonding, color, and texture of new masonry with existing masonry.

E. Anchoring:

1. Anchor all veneer types to structural backing wall or to structural columns as shown on Drawings and in conformance to the International Building Code.
2. Maintain a space not less than 1 inch wide between masonry wall and concrete members.

3. Keep space free of mortar or other rigid material to permit differential movement between backing wall and masonry.
4. Attach veneer to backing with anchor ties.
    a. Use one anchor tie for each1.77 square feet of wall area.
    b. Maximum Space between Adjacent Ties:
        1) Vertically: 16 inches.
        2) Horizontally: 16 inches.
    c. Embed ties at least 2 inches in horizontal joint of veneer.
    d. Provide additional ties at openings:
        1) Maximum Spacing Around Perimeter: 24 inches.
        2) Install within 12 inches of opening.

3.04 MASONRY VENEER WALL CONSTRUCTION—GENERAL

A. Mortar Beds: Lay masonry with full mortar coverage on horizontal and vertical joints. Rock closures into place with head joints thrown against two adjacent units in-place. Do not pound corners or jambs to fit stretcher units after setting in-place. Where adjustment to corners or jambs must be made after mortar has started to set, remove mortar and replace with fresh mortar.

B. Horizontal and Vertical Face Joints:

1. Nominal Thickness: 3/8 inch.
2. Construct uniform joints.
3. Shove vertical joints tight.
4. Tool joints concave in exposed surfaces when thumbprint hard using jointing tool.
5. Concave tool exterior joints below grade.
6. Flush cut all joints not tooled.
7. Fill horizontal joints between top of masonry partition and underside of concrete beams with mortar.

C. Movement Joints: Keep clean of all mortar and debris.

D. Masonry Control Joints:

1. Provide continuous vertical control joints in masonry as shown on Drawings.
2. Omit mortar from vertical joints. Place control joint material as wall is built.

E. Through-Wall Flashing:

1. Place flashing on bed of mortar.
2. Lap cross joints of through-wall flashing at least 2 inches.

3. Extend flashing beyond exterior face of wall and provide drip edge.
4. Cover flashing with mortar.

F. Flashing: Clean surface of masonry smooth and free from projections that might puncture, gouge, or otherwise damage flashing material.

G. Weep Holes: Provide weep holes in head joints in first course immediately above all flashing leaving head joint free and clean of mortar. Install weep hole tube in head joint per manufacturer's instructions.

1. Maximum Spacing: 24 inches OC.
2. Keep weep holes and area above flashing free of mortar droppings.

H. Sealant Joints:

1. Retain sealant joints around outside perimeters of exterior doors, louver frames, and other wall openings:
   a. Uniform Depth: 3/4 inch.
   b. Uniform Width: 1/4 inch.

I. Pointing: Cut out defective joints and holes in exposed masonry and repoint with mortar. Dry brush masonry surface after mortar has set at end of each day's Work and after final pointing.

3.05 CONCRETE MASONRY UNIT VENEER INSTALLATION

A. General: Do not install cracked, broken, or chipped masonry units exceeding ASTM C216 allowances. Thoroughly wet masonry just before laying except in freezing weather where units are laid dry. Prewetting may also be omitted if the units at the time of laying has a rate of absorption not exceeding 0.025 ounce of water per square inch of surface after being placed in 1/8 inch of water for 1 minute.

1. Coordinate installation with backup walls, through wall flashing, and other construction. Use masonry saws to cut and fit exposed units. Lay units plumb, true to line, with level courses accurately spaced, and do not furrow bed joints.
2. Finish horizontal run by racking back in each course; toothing not permitted. Adjust all units to final position while mortar is soft and plastic. If units are displaced after mortar has stiffened, remove, clean joints and units of mortar, and relay with fresh mortar.

3. Bond unexposed units in wythe by lapping a minimum of 2 inches. Adjust ledger support members to keep Work level at proper elevation. Provide pressure relieving joints by placing a continuous compressible pad under ledger support members.
4. When joining fresh masonry to set or partially set masonry:
    a. Remove loose concrete masonry unit and mortar.
    b. Clean and lightly wet exposed surface of set masonry prior to laying fresh masonry.

B. Pattern: Lay masonry in running bond.

3.06 BRICK VENEER INSTALLATION

A. General: Do not install cracked, broken, or chipped masonry units exceeding ASTM C216 allowances. Thoroughly wet brick just before laying except in freezing weather where bricks are laid dry. Prewetting may also be omitted if the brick at the time of laying has a rate of absorption not exceeding 0.025 ounce of water per square inch of surface after being placed in 1/8 inch of water for 1 minute.

1. Coordinate installation with backup walls, through wall flashing, and other construction. Use masonry saws to cut and fit exposed units. Lay brick plumb, true to line, with level courses accurately spaced, and do not furrow bed joints.
2. Finish horizontal run by racking back in each course; toothing not permitted. Adjust all units to final position while mortar is soft and plastic. If units are displaced after mortar has stiffened, remove, clean joints and units of mortar, and relay with fresh mortar.
3. Bond unexposed units in wythe by lapping a minimum of 2 inches. Adjust shelf angles to keep Work level at proper elevation. Provide pressure relieving joints by placing a continuous compressible pad under the shelf angle.
4. When joining fresh masonry to set or partially set masonry:
    a. Remove loose brick and mortar.
    b. Clean and lightly wet exposed surface of set masonry prior to laying fresh masonry.

B. Pattern: Lay brick in running bond with soldier courses as shown on the Drawings.

3.07 SETTING CAST STONE

A. Clean stone immediately before setting.

B. Set each piece accurately, true to line, level, and plumb, in full bed of fresh mortar. Completely fill all joints and beds with fresh mortar.

C. Install anchor system as shown.

D. After stones are set in mortar, do not move or disturb in any manner that might destroy bond between cast stone and mortar. Cast stones that have been disturbed shall be removed and reset in fresh mortar.

E. Keep faces of cast stone free of mortar. Promptly remove mortar splashed on stone faces and other surfaces.

F. Upon completion, clean face of stone with stiff fiber brushes and detergent and water. Rinse thoroughly with fresh water.

3.08 SETTING CAST STONE COPPING CAP

A. Cast stone coping cap shall be installed over stainless steel flashing per Specification Section 07 62 00, Sheet Metal Flashing and Trim.

B. Prior to setting each precast cap, center a 3-inch square rubberized asphalt gasket at each of the stone anchor locations. Coordinate locations with receptor slots in precast coping.

C. Start with the stainless steel L anchor at the end piece of precast coping. Attach with 1/4 inch diameter by 2-1/4-inch stainless steel expansion anchor. Follow using the split tail anchors for each additional piece of precast.

D. Stone coping can be set in bed of mortar used as a leveling bed or dry laid on plastic shims. If mortar is used rake joints back 3/8 inch to receive backer rod and sealant at all exposed joints.

E. Once the coping is in place the head and bed joints receive backer rod and polyurethane sealant. Sealant to be custom color to match cast stone coping. Provide an additional continuous bead of sealant under the hemmed drip edge of the through wall flashing.

3.09 CLEANING

A. Cleaning Agents:

1. Proprietary Acidic Cleaner: Manufacturer’s standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.

B. Follow masonry and mortar color manufacturer's recommendations for use of cleaning agents.

C. Application:

1. Thoroughly wet surface of masonry on which no efflorescence appears before using cleaning agent.
2. Scrub with acceptable cleaning agent.
3. Immediately rinse with clean water.
4. Work small sections at a time.
5. Work from top to bottom.
6. Protect sash, metal lintels, and other materials, which may corrode when masonry is cleaned with acid solution.
7. Remove efflorescence in accordance with masonry manufacturer's recommendations.

D. Leave Work area and surrounding surfaces clean and free of mortar spots, droppings, and broken masonry.

3.10 FIELD QUALITY CONTROL AND QUALITY CONTROL

A. At least once a week while installation of masonry veneer is in progress, take mortar Samples for testing. Continue on that basis for duration of installation of masonry veneer at discretion of Engineer.

B. Take Samples in accordance with ASTM C270.

C. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in Statement of Special Inspections Plan in Supplement located at end of Section 01 45 33, Special Inspection, Observation, and Testing. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

D. Contractor-Furnished Quality Control: Inspect and test as required in Section 01 45 16.13, Contractor Quality Control.

3.11 WATER REPELLANT

A. As specified in Section 07 19 00, Water Repellant.

3.12 PROTECTION

A. Wall Covering: During erection, cover top of wall with strong waterproof membrane at end of each day or shutdown and as follows:

1. Cover partially completed walls when Work is not in progress.
2. Extend cover minimum of 24 inches down both sides.
3. Hold cover securely in-place.

B. Protect sills, ledges, and offsets from mortar drippings or other damage during construction. Remove misplaced mortar immediately. Protect face materials against staining. Protect the door jambs and corners from damage during construction.

END OF SECTION

SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A1064/A82M, Standard Specification for Carbon-Steel Wire, and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   c. C33, Standard Specification for Concrete Aggregates.
   d. C90, Standard Specification for Loadbearing Concrete Masonry Units.
   e. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   f. C144, Standard Specification for Aggregate for Masonry Mortar.
   g. C150, Standard Specification for Portland Cement.
   h. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
   i. C270, Standard Specification for Mortar for Unit Masonry.
   j. C404, Standard Specification for Aggregates for Masonry Grout.
   k. C476, Standard Specification for Grout for Masonry.
   l. C618 12 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   m. C744, Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
   n. C979, Pigments for Integrally Colored Concrete.
   o. C989, Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
   p. C1403, Standard Test Method for Rate of Water Absorption of Masonry Mortars.
2. The Masonry Society (TMS):
   a. TMS 402/ACI 530/ASCE 5; Building Code Requirements for Masonry Structures and Companion Commentaries. (MSJC Code and Commentary).
   b. TMS 602/ACI530.1/ASCE6; Specification for Masonry Structures.
   c. 602/American Concrete Institute ACI 530.1/ASCE 6, Specification for Masonry Structures and Companion Commentaries. (Masonry Standards Joint Committee Specifications and Commentary).

3. International Code Council (ICC):
    a. International Building Code (IBC).
    b. ICC Evaluation Service (ICC-ES) Reports.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings.
2. Data Sheets:
    a. Horizontal joint reinforcement.
    b. Preformed control joint materials.
    c. Water repellant masonry sealer.
    d. Grout mix design.
    e. Mortar mix design.
    f. Grout sand gradation in accordance with ASTM C404.
3. Samples:
    a. Sample: One of each type of masonry unit to be used on Project from the proposed manufacturer.
    b. Mortar colors for color selection.

B. Informational Submittals:

1. Method and Location of Placing Grout: High lift or low lift.
2. Mix design test results.
3. Certifications:
    a. Units comply with ASTM C55 and ASTM C90.
    b. Grout test results conform to ASTM C1019.
    c. Grout aggregates conform to requirements of ASTM C33, including nonreactivity.
    d. Mortar sand conform to requirements of ASTM C144.
4. Test results of Project samples from masonry unit manufacturer stating that units comply with ASTM C90. Documentation of material testing shall be one less than 1 year old.
5. Test results of proposed grout mix deign stating that units comply with ASTM C1019. Documentation of material testing shall be 1 year old or less.
6. Test reports stating aggregates for mortar meet requirements of ASTM C144.
7. Test reports or letter of certification stating aggregates for grout meet requirements of ASTM C404.
8. Method and materials for removal of efflorescence.
9. Field test results to qualify materials.
    a. Grout tests in accordance with ASTM C1019.

1.03 QUALITY ASSURANCE

A. Mockups:

1. Lay up Sample panel for each type of masonry at Site.
2. Dimensions: Minimum 4 feet high by 4 feet long.
3. Use approved materials and procedures.
4. May be part of permanent construction.
5. Approved panels shall serve as basis of color, texture, bond, quality of finished joints, surface applied finishes, and for acceptance of permanent construction.
6. Demonstrate ability to keep grout isolated and in certain cells during any sequence of placement, and to demonstrate materials will be restricted to cells and bond beams intended to receive grout.
7. Construction shall show areas required to receive mortar, including webs on each side of each grouted cell to prevent grout from entering adjacent cells or courses.
8. Where bond beams are to be used, demonstrate proper placement of grout to bond beam level, and proper placement of bond beam prior to placement of grout above bond beam level.
9. Demonstrate proper use of running bond.
10. Compliance Requirements: For masonry finish and appearance, dimension tolerances, tolerances of construction, joint tolerances, and wall plumb tolerances, comply with the requirements and criteria of NCMA, ASTM C90, and TMS 602.1.

B. Preinstallation Conference:

1. Required Meeting Attendees:
   a. Masonry subcontractor, including masonry foreman.
   b. Ready-mix producer.
   c. Admixture representative.
   d. Testing and sampling personnel.
   e. Design Structural Engineer.
2. Schedule and conduct prior to start of masonry construction.
3. Notify Engineer of location and time.
4. Agenda shall include:
   a. High lift and low lift procedures.
   b. Mortar, grout, unit, and reinforcing submittals.
   c. Types and locations of rebar splices.
   d. Joint tooling.
   e. Admixture types, dosage, performance, and redosing at Site.
   f. Mix designs and test of mix.

g. Placement methods, techniques, equipment, consolidation, and reconsolidation.
h. Protection procedures for environmental conditions.
i. Other specified requirements requiring coordination.

5. Submit conference minutes as specified in Section 01 31 19, Project Meetings.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Keep units and mortar/grout cementitious ingredients, including lime, dry.

PART 2 PRODUCTS

2.01 COMPRESSIVE STRENGTH OF MASONRY ASSEMBLAGE

A. Minimum 28-Day Specified Compressive Strength (f'm) of Masonry: 2,000 psi.

2.02 CONCRETE MASONRY UNITS (CMU)

A. ASTM C90: Lightweight.

1. Net Area Compressive Strength: 2,800 psi minimum, in accordance with TMS 602, Table 2.
2. Nominal Size: 16 inches long by 8 inches high by thickness shown on Drawings.
3. Color of Units: Natural.
4. Surface Texture on Exposed Surfaces: Smooth.
5. Surface Texture: Smooth on interior, concealed exterior, and surface 1 foot below finished grade.

B. General Concrete Masonry Unit (CMU) Requirements:

1. Furnish or cut special shapes for corners, jambs, lintels, and other areas shown or required.
2. Special units shall match color and texture of standard units.
3. Where units are placed so end of unit is exposed, such as at a corner or intersection, exposed end of that block shall have surface to match color and texture of sides of other units.
4. Furnish sound, dry, clean units free of cracks, prior to placing in structure.

5. Vertical Cells to be Grouted: Capable of alignment sufficient to maintain clear, unobstructed continuous vertical cell dimensions in accordance with TMS 602, Table 7.
6. Masonry unit size and shape shall allow for all placement patterns. Use vertical grout dams to prevent materials, such as grout, from escaping from cell being filled to adjacent cells where material is not intended to be placed.

2.03 MORTAR MATERIALS

A. Portland Cement-Lime Mortar:

1. ASTM C270.
2. Cement: ASTM C150, Type I and Type II portland cement.
3. Lime: ASTM C207, Type S hydrated.
4. Aggregates:
   a. Non-reactive in accordance with ASTM C33, Appendix X1.
   b. Mortar: ASTM C144, sand.

B. Mortar Cement Mortar: ASTM C1329.

C. Masonry Cement Mortar: ASTM C91.

D. Water: Fresh, clean, and potable.

2.04 GROUT MATERIALS

A. Cement: ASTM C150, Type I and Type II portland cement.

B. Fly Ash: Fly Ash (Pozzolan): Class F and Class C fly ash in accordance with ASTM C618.

C. Slag Cement: In accordance with ASTM C989, Grade 100 or Grade 120.

D. Lime: ASTM C207, Type S hydrated.

E. Aggregates:

1. ASTM C404, fine and coarse.
2. Non-reactive in accordance with ASTM C33, Appendix X1.

F. Water: Fresh, clean, and potable.

2.05 REINFORCEMENT

A. Reinforcement: Clean and free from loose rust, scale, and coatings that reduce bond.

B. Deformed Bars: As specified in Section 03 30 00, Cast-In-Place Concrete.

C. Horizontal Joint Reinforcement:

1. Two parallel, ASTM A82/A82M, No. 9 wires, galvanized in accordance with ASTM A153/A153M, weld connected to No. 9 perpendicular or diagonal cross wire at 16 inches, maximum, center.
2. Furnish special manufactured corner and wall intersection pieces.
3. Manufacturer: Dayton Superior/Dur-O-Wal, Dayton, OH.

2.06 PREFORMED CONTROL JOINTS

A. Solid rubber cross-shape extrusions as manufactured by:

1. Dayton Superior/Dur-O-WalDayton, OH; DA 2001 Control Joint Regular Rubber.
2. Hohmann and Barnard, Inc, Hauppauge, NY; #RS-Standard.

2.07 MORTAR MIXES

A. In accordance with ASTM C270, Type S and MSJC Specifications.

B. Mix Method:

1. Property Method: Minimum average mortar 28-day compressive strength 1,800 psi.

C. Mixing: Machine mix in approved mixers in accordance with ASTM C270.

2.08 GROUT MIXES

A. Compressive Strength Property: Minimum 2,000 psi at 28 days. Grout strength shall not exceed two times the minimum specified strength at 28 days.

B. Mix Design:

1. Proportions:
   a. Design mix to meet property/strength requirements.
   b. Where fly ash or slag is included in mix, fly ash or slag content shall be a minimum of 25 percent and a maximum of 40 percent of weight of total cementitious materials.
2. Slump: 8-inch minimum, 11-inch maximum.

C. Mixing:

1. Do not use water reducers, air entrainment, plasticizing, high-range water reducers, or other non-specified admixtures in grout mixes.
2. Transit-Mixed Grout: Meet requirements of ASTM C476.
3. For high lift grouting, add approved grout expansion admixture in accordance with manufacturer's recommendations.
4. Fluid consistency suitable for placing without segregation with a slump of 8 inches to 11 inches.

PART 3 EXECUTION

3.01 GENERAL

A. Meet requirements of 2018 IBC, Chapter 21 and 2016 The Masonry Society (TMS) 602/American Concrete Institute (ACI)530.1/ASCE 6, Specification for Masonry Structures and Companion Commentaries (MSJC), Part 3, Execution, except as modified in this section.

B. Moisture Protection:

1. Keep units dry while stored on Site.
2. Do not wet units prior to laying.

C. Provide measures to prevent moisture from entering incomplete walls and open cells.

D. Cold Weather: Meet requirements of MSJC Specification Section "Cold Weather Construction".

E. Hot Weather: Meet requirements of MSJC Specification Section "Hot Weather Construction".

F. After construction during cold weather, maintain newly constructed masonry temperature above 32 degrees F for a minimum of 24 hours using MSJC or other approved cold weather methods.

G. After construction and during hot weather, fog spray newly constructed masonry in accordance with MSJC hot weather construction requirements.

3.02 PREPARATION

A. Concrete Foundations: Meet tolerance requirements of ACI 117 prior to starting any masonry work.

B. Prepare surface contact area of foundation concrete for initial mortar placement by removing laitance, loose aggregate, and other materials, and anything that would prevent mortar from bonding to foundation.

C. Patch or grind out-of-tolerance foundation surfaces to receive mortar prior to starting masonry work.

D. Clean reinforcement dowels and projecting embeds by removing laitance, spillage, or items that will adversely affect grout bond.

E. Prevent surface damage to foundation concrete that will be exposed to view outside of contact area.

3.03 LAYING MASONRY UNITS

A. General:

1. Finish Tolerances (Measured on Interior Surfaces): Meet requirements of “Site Tolerance” requirements of Part 3, Execution, of the MSJC Specifications.
2. Place units with chipped edges or corners such that chipped area is not exposed to view.

B. Wall Units:

1. General:
   a. If necessary to move a unit after once set in-place, remove from wall, clean, and set in fresh mortar.
   b. Toothing of masonry units is not permitted.
2. Running Bond:
   a. Unless otherwise shown, lay up walls in straight, level, and uniform courses using a running bond pattern.
   b. Place units for continuous vertical cells and mortar joints to prevent materials, such as grout, from escaping from cell being filled to adjacent cells where material is not intended to be placed.
   c. Corners: Lay standard masonry bond for overlapping units and grout solid.
   d. Intersecting Walls: Half unit appearance shall not extend and be visible on exterior side of intersecting wall. Provide hooked corner bars in bond beam units as shown on Drawings.

3. Special Shapes:
   a. Provide and place such special units as corner block, doorjamb block, lintel block fillers, and similar blocks as may be required.
   b. Use required shapes and sizes to work to corners and openings, maintaining proper bond throughout wall.

3.04 BUILT-IN ITEMS

A. Position door frames, windows, vents, louvers, and other items to be built in wall, and construct wall around them.

B. Install masonry anchors to secure items to wall.

C. Fill spaces around items with grout except use mortar at mortar joints.

D. Do not place electrical, instrumentation, or water conduits in a cell containing parallel reinforcement, unless approved in writing by Engineer. Additionally, pipes, sleeves, and conduits shall meet requirements of TMS 402/ACI 530/ASCE 5, Building Code Requirements for Masonry Structures (MSJC Code) and MSJC specification construction requirements.

3.05 MORTAR JOINTS

A. General:

1. Meet masonry erection requirements of MSJC, Part 3, Execution, 3.3B.
2. As units are laid, remove excess mortar from grout space of cells to be filled. Final grout space, including any remaining mortar projections, shall be as required by MSJC Table “Grout Space Requirements”.
3. Place mortar before initial setting of cement takes place. Retemper only as required for it to remain plastic. Retempering of colored mortar is not allowed.

B. Exposed Joints:

1. Tool joints exposed to view after final construction, unless otherwise noted or shown.
2. Cut joints flush and as mortar takes its initial set; tool to provide a concave joint.
3. Perform tooling with tool that compacts mortar, pressing excess mortar out.
4. Perform tooling when mortar is partially set, but still sufficiently plastic to bond rather than dragging it out.
5. Rake out joints that are not tight at time of tooling, point, and then tool.
6. Rake and tool joints at split-face surfaces, interior and exterior.

C. Concealed Joints: Strike flush with no further treatment required.

3.06 CONTROL JOINTS

A. Preformed Control Joints:

1. Omit mortar from vertical joints.
2. Place in units fabricated to receive rubber control joint material as wall is built.
3. After wall is grouted, cured, and cleaned, install backing rod and sealant as specified in Section 07 92 00, Joint Sealants.
4. Place and tool sealant to match depth of typical joint.

3.07 REINFORCING

A. Foundation Dowels:

1. Locate first foundation dowel at end of wall in center of first cell; typically 4 inches from end of wall.
2. Locate at each side of control joints and openings and below beam and joist seats, and then locate at maximum required spacing between these bars.
3. Size, number, and location of foundation dowels shall match all typical and additional vertical wall reinforcing, unless otherwise noted.
4. When foundation dowel does not line up with vertical core, do not slope more than 1 horizontal to 6 vertical to bring it into alignment.

B. Vertical Reinforcing:

1. Use deformed bars.
2. Hold in position near ends of bars by wire ties to dowels or by reinforcing positioners.
3. For high lift grouting, hold in position at maximum intervals of 160 bar diameters by reinforcing positioners.
4. Lap reinforcing bars as shown or approved.
5. Wire tie splices together.
6. Minimum Bar Clearance: 1/2-inch from masonry for coarse grout 1/4-inch from masonry for fine grout, from formed surfaces, and from parallel bars in same grout space.

C. Horizontal Reinforcing:

1. Use deformed bars.
2. Lay on webs of bond beam units and place as wall is built. Increase web depth to ensure 1/2-inch cover over top of rebar.
3. Lap reinforcing bars where spliced and wire tie together.

4. Minimum Bar Clearance: 1/2 inch from masonry for coarse grout 1/4 inch from masonry for fine grout, from formed surfaces, and from parallel bars in same grout space.
5. Terminate reinforcing bars 2 inches clear from control joints except horizontal bars at roof and floor courses shall be continuous through joints.

D. Horizontal Joint Reinforcement:

1. Use where indicated on Drawings.
2. Provide in addition to typical, deformed horizontal reinforcing steel.
3. Space maximum 16 inches apart, vertically.
4. Lap ends 16 inches minimum.
5. Terminate reinforcing 2 inches clear from control joints except reinforcement at roof and floor courses shall be continuous through joints.
6. Use manufactured corner and other wall intersection pieces.

3.08 MORTAR PRODUCTION

A. Mix bulk materials in accordance with MSJC Specification.

B. Mix prebagged materials with water to produce a workable consistency.

C. Remix or retemper to maintain workability. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours after initial mixing.

3.09 GROUT PLACEMENT

A. Do not mix, convey, or place with equipment constructed of aluminum.

B. Secure vertical and horizontal reinforcement, ties, bolts, anchors, and other required embedments in place; inspect and verify before placing grout.

C. Grout beams over openings in one continuous operation.

D. Maintain vertical alignment in accordance with ACI 530.1, Table 7:

1. Place grout within 1-1/2 hours of addition of water to mix.
2. Use reinforcing positioners to secure vertical reinforcement.

E. Grouting Requirements:

1. Partial grout all walls as shown.
   a. Slump: 8 inches to 11 inches.
   b. Do not start grouting until wall mortar has cured for 24 hours, minimum.

2. Fully embed horizontal steel with grout in an uninterrupted pour.
3. Do not construct wall more than one course above top of grout pour prior to placing grout.
4. Partial Grouting Requirements:
    a. Fill cells containing reinforcing steel, anchor bolts, and other embedded items as shown with grout.
    b. Construct cells to be filled to confine grout within cell.
    c. Cover tops of unfilled vertical cells under a bond beam with metal lath to confine grout fill to bond beam section.
    d. Form horizontal construction joints between pours by stopping grout pour 1-1/2 inches below a mortar joint, except at a bond beam; stop pour 1/2 inch below top of masonry unit.

F. Vibration:

1. Use internal “pencil” type, low energy vibrator to thoroughly consolidate grout and reduce amount of air voids. Do not use concrete vibrators.
2. After initial water loss and settlement has occurred, but before it has taken any set, reconsolidate grout.
3. Waiting period for reconsolidation will vary depending upon weather conditions and block absorption rates, but under “normal” weather conditions with average masonry units the waiting period should be between 30 minutes and 60 minutes.

G. Cleanouts:

1. Construct in accordance with MSJC specification.
2. Provide for grout pours heights over 5 feet 4 inches in accordance with the 2018 IBC.
3. Provide of sufficient size to permit cleaning of cell, positioning of reinforcing, and inspection at bottom of every vertical cell containing reinforcing and maximum of 32 inches on center.
4. Location: Concealed from view after final construction, unless otherwise approved by Engineer.
5. After wall has been inspected and approved and prior to grouting, cap cleanouts in a manner that will seal them from grout leakage and provide a flush finish.

3.10 FIELD QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan in Supplement located at end of Section 01 45 33, Special Inspection, Observation, and Testing. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

C. Masonry shall be tested by testing agency retained by Owner.

D. Provide adequate facilities for safe storage and proper curing of masonry prisms, mortar samples, and grout samples, as applicable, onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

E. Masonry Testing:

1. Masonry strength shall be determined using unit strength method as shown.
2. Unit Strength Method:
    a. Method and frequency for mortar, grout, and masonry unit sampling and testing shall be as shown.
    b. Provide masonry units for test samples required.

F. Corrective Action:

1. If compressive strength tests made prior to construction of permanent structure fail to meet Specifications, adjustments shall be made to mix designs for mortar, or grout, or both, as needed to produce specified strength.
2. If strength tests performed on materials representative of in-place construction fail to meet Specifications, prisms or cores shall be cut from constructed walls in sufficient locations to adequately determine strength in accordance with IBC 2105.3.

3.11 CLEANING

A. Immediately after completion of grouting, clean masonry surfaces of excess mortar, grout spillage, scum, stains, dirt, and other foreign substances using clean water and fiber brushes.

B. Clean walls not requiring painting or sealing so there are no visible stains.

3.12 PROTECTION OF INSTALLED WORK

A. Do not allow grout and mortar stains to dry on face of exposed masonry.

B. Protect tops of walls at all times. Cover tops of walls with waterproof paper when rain or snow is imminent and when the Work is discontinued.

C. Adequately brace walls until walls and roof are completed.

D. Provide sufficient bracing to protect walls against damage from elements, including wind and snow.

E. Protect masonry against freezing for minimum 72 hours after being laid.

F. Protect masonry from damage until final acceptance of the Work. Damaged units will not be accepted.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C661, Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.
   b. C834, Standard Specification for Latex Sealants.
   c. C920, Standard Specification for Elastomeric Joint Sealants.
   d. C1193, Standard Guide for Use of Joint Sealants.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Surface preparation instructions. Indicate where each product is proposed to be used.
2. Samples: Material proposed for use showing color range available.

B. Informational Submittals:

1. Installation instructions.
2. Documentation showing applicator qualifications.
3. Manufacturer’s Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
4. Special guarantee.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum of 5 years’ experience installing sealants in projects of similar scope.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Ambient Temperature: Between 40 degrees F and 80 degrees F (4 degrees C and 27 degrees C) when sealant is applied. Consult manufacturer when sealant cannot be applied within these temperature ranges.

1.05 SPECIAL GUARANTEE

A. Product: Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction or, at the option of the Owner, removal and replacement of Work specified in this section found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.

B. Conditions: No adhesive or cohesive failure of sealant.

C. Sealed Joints: Watertight and weathertight with normal usage.

PART 2 PRODUCTS

2.01 SEALANT MATERIALS

A. Characteristics:

1. Uniform, homogeneous.
2. Free from lumps, skins, and coarse particles when mixed.
3. Nonstaining, nonbleeding.
4. Hardness of 15 minimum and 50 maximum, measured by ASTM C661 method.
5. Immersible may be substituted for nonimmersible.

B. Color: Unless specifically noted, match color of the principal wall material adjoining area of application.

C. Type 1—Silicone, Nonsag, Nonimmersible:

1. Silicone base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
2. Capable of withstanding movement up to 50 percent of joint width.
3. Manufacturers and Products:
   a. Dow Corning Corp.; No. 790.
   b. General Electric; Silpruf.
   c. BASF; Sonneborn, Omniseal-50.

D. Type 2—Multipart Polyurethane, Self-leveling, Immersible:

1. Polyurethane base, multicomponent, chemical curing; ASTM C920, Type M, Grade P, Class 25.
2. Capable of being continuously immersed in water.

3. Manufacturers and Products:
    a. BASF; Sonneborn, SL-2.
    b. Pecora Corp.; Urexspan NR-200.
    c. Tremco; THC-900/901.
    d. Sika Chemical Corp.; Sikaflex 2c SL.

E. Type 3—Multipart Polyurethane, Nonsag, Immersible:

1. Polyurethane base, multicomponent, chemical curing; ASTM C920, Type M, Grade NS, Class 25.
2. Capable of being continuously immersed in water.
3. Manufacturers and Products:
    a. Pecora; DynaTrol II.
    b. Tremco; Dymeric 240.
    c. BASF; Sonneborn NP-2.
    d. Sika Chemical Corp.; Sikaflex 2c NS.

F. Type 5—One-part Polyurethane, Immersible:

1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or P, Class 25.
2. Capable of being continuously immersed in water.
3. Manufacturers and Products for Nonsag:
    a. Sika Chemical Corp.; Sikaflex-1a.
    b. Tremco; Vulkem 116.
4. Manufacturers and Products for Self-leveling:
    a. BASF; Sonneborn, SL-1.
    b. Tremco; Vulkem 45.
    c. Sika Chemical Corp.; Sikaflex 1c SL.

G. Type 8—One-Part Polysulfide, Nonsag, Nonimmersible:

1. Polysulfide base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 12 1/2.
2. Capable of withstanding movement up to 20 percent of joint width.
3. Manufacturer and Product: W. R. Meadows; Deck-O-Seal, one-part.

H. Type 10—Sanitary Sealant:

1. Silicone sealant similar to Type 1, above, formulated to resist mold growth and repeated exposure to high humidity while retaining adhesion, flexibility, and color.
2. Manufacturers and Products:
    a. Dow Corning; 786.
    b. General Electric; Sanitary Sealant SCS1700.

I. Type 11—Fire Penetration Seal:

1. Manufacturers and Products:
   a. 3M Corp.; Fire Barrier Caulk CP25 and Putty 303.
   b. General Electric; Pensil Sealant or Foam.
   c. Unifrax Corporation; Fyre Putty.
   d. Hilti USA; CP 604.

J. Type 12—One-Part Polycarbonate, Immersible:

1. Polycarbonate base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
2. Capable of being continuously immersed in water.
3. Manufacturer and Product: Pro-Seal Products, Inc.; Pro-Seal 34.

K. Type 13—Tape Sealant:

1. Compressible polyurethane foam impregnated with polybutylene or polymer-modified asphalt.
2. Color: Black.
3. Size: 3/4 inch wide by length required by expanded thickness recommended by manufacturer for particular application.
4. Manufacturers and Products:
   a. Emseal Joint Systems, Ltd.; AST—High Acrylic.
   b. Dayton Superior; Polytite Standard.
   c. PARR Technologies; PARR Sealant EP-7212-T.

2.02 BACKUP MATERIAL

A. Nongassing, extruded, closed-cell round polyurethane foam or polyethylene foam rod, compatible with sealant used, and as recommended by sealant manufacturer.

B. Size: As shown or as recommended by sealant material manufacturer. Provide for joints greater than 3/16-inch wide.

C. Manufacturers and Products:

1. Sonneborn; Sonolastic Closed-cell Backing Rod.
2. Tremco; Closed-cell Backing Rod.
3. Pecora Corporation; Green Rod.

2.03 ANCILLARY MATERIALS

A. Bond Breaker: Pressure sensitive tape as recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Primer: Nonstaining type recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 GENERAL

A. Use of more than one material for the same joint is not allowed unless approved by sealant manufacturer.

B. Install joint sealants in accordance with ASTM C1193.

C. Horizontal and Sloping Joints up to 1 Percent Maximum Slope: Use self-leveling (Grade P) joint sealant.

D. Steeper Sloped Joints, Vertical Joints, and Overhead Joints: Use nonsag (Grade NS) joint sealant.

E. Use joint sealant as required for the applicable application and as follows:

Joint Size	Sealant Type
Less than 1"	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or 12
Less than 2"	1, 2, 3, 4, or 7
Over 2"	Follow manufacturer’s recommendation

3.02 PREPARATION

A. Verify that joint dimensions, and physical and environmental conditions, are acceptable to receive sealant.

B. Surfaces to be sealed shall be clean, dry, sound, and free of dust, loose mortar, oil, and other foreign materials.

1. Mask adjacent surfaces where necessary to maintain neat edge.
2. Starting of work will be construed as acceptance of subsurfaces.
3. Apply primer to dry surfaces as recommended by sealant manufacturer.

C. Verify joint shaping materials and release tapes are compatible with sealant.

D. Examine joint dimensions and size materials to achieve required width/depth ratios.

E. Follow manufacturer's instructions for mixing multi-component products.

3.03 INSTALLATION

A. Use joint filler to achieve required joint depths, to allow sealants to perform intended function.

1. Install backup material as recommended by sealant manufacturer.
2. Where possible, provide full length sections without splices; minimize number of splices.
3. Tape sealant may be used as joint filler if approved by sealant manufacturer.

B. Use bond breaker where recommended by sealant manufacturer.

C. Seal joints around window, door and louver frames, expansion joints, control joints, and elsewhere as indicated.

D. Joint Sealant Materials: Follow manufacturer's recommendation and instructions, filling joint completely from back to top, without voids.

E. Joints: Tool slightly concave after sealant is installed.

1. When tooling white or light color sealant, use a water wet tool.
2. Finish joints free of air pockets, foreign embedded matter, ridges, and sags.

F. Tape Sealant: Compress to 50 percent of expanded thickness and install in accordance with manufacturer's instructions.

3.04 CLEANING

A. Clean surfaces next to the sealed joints of smears or other soiling resultant of sealing application.

B. Replace damaged surfaces resulting from joint sealing or cleaning activities.

3.05 JOINT SEALANT SCHEDULE

A. This schedule lists the sealant types acceptable for each joint location. Use as few different sealant types as possible to meet the requirements of Project.

Joint Locations	Sealant Type(s)
Expansion/Contraction and Control Joints At:	
Concrete Floor Slabs (except for water-holding Structures)	2, 5
Slabs Subject to Vehicle and Pedestrian Traffic	2, 5
Ceramic Tile Floors	1, 2, 5, 10
Ceramic Tile Walls	1, 3, 5, 10
Material Joints At:	
Metal Door, Window, and Louver Frames (Exterior)	1, 5, 6, 8, 12
Metal Door, Window, and Louver Frames (Interior)	1, 5, 8,
Wall Penetrations (Exterior)	1, 5, 8, 12
Wall Penetrations (Interior)	1, 5, 8
Floor Penetrations	5
Ceiling Penetrations	1, 3, 5,
Roof Penetrations	5
Sheet Metal Flashings	5, 13
Precast Concrete Wall Panels	1, 3, 5, 12, 13
Other Joints:	
Threshold Sealant Bed	5
Between Counter Tops and Backsplashes	10
Around Plumbing Fixtures	10
Openings Around Pipes, Conduits, and Ducts Through Fire-Rated Construction	11
Concrete Form Snap-Tie Holes	1, 5

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D877/D877M, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.
   b. D923, Standard Practices for Sampling Electrical Insulating Liquids.
   c. D924, Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.
   d. D971, Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method.
   e. D974, Standard Test Method for Acid and Base Number by Color-Indicator Titration.
   f. D1298, Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
   g. D1500, Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale).
   h. D1524, Standard Test Method for Visual Examination of Used Electrical Insulating Liquids in the Field.
   i. D1533, Standard Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration.
   j. D1816, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes.
2. Institute of Electrical and Electronics Engineers (IEEE):
   a. 43, Recommended Practice for Testing Insulation Resistance of Electric Machinery.
   b. 48, Standard Test Procedures and Requirements for Alternating-Current Cable Terminators Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV.
   c. 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
   d. 95, Recommended Practice for Insulation Testing of AC Electric Machinery (2300V and Above) with High Direct Voltage.

e. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V.
f. 400, Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above.
g. 450, Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
h. C2, National Electrical Safety Code.
i. C37.20.1, Standard for Metal-Enclosed Low-Voltage (1000 Vac and below, 3200 Vdc and below) Power Circuit Breaker Switchgear.
j. C37.20.2, Standard for Metal-Clad Switchgear.
k. C37.20.3, Standard for Metal-Enclosed Interrupter Switchgear.
l. C37.23, Standard for Metal-Enclosed Bus.
m. C62.33, Standard Test Methods and Performance Values for Metal-Oxide Varistor Surge Protective Components.

3. Insulated Cable Engineers Association (ICEA):
   a. S-93-639, 5-46 kV Shielded Power Cables for Use in the Transmission and Distribution of Electric Energy.
   b. S-94-649, Concentric Neutral Cables Rated 5 through 46 kV.
   c. S-97-682, Standard for Utility Shielded Power Cables Rated 5 through 46 kV.
4. National Electrical Manufacturers Association (NEMA):
   a. AB 4, Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
   b. PB 2, Deadfront Distribution Switchboards.
   c. WC 74, 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.
5. InterNational Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
   b. 70B, Recommended Practice for Electrical Equipment Maintenance.
   c. 70E, Standard for Electrical Safety in the Workplace.
   d. 101, Life Safety Code.
7. National Institute for Certification in Engineering Technologies (NICET).
8. Occupational Safety and Health Administration (OSHA): CFR 29, Part 1910, Occupational Safety and Health Standards.

1.02 SUBMITTALS

A. Informational Submittals:

1. Submit 30 days prior to performing inspections or tests:
   a. Schedule for performing inspection and tests.
   b. List of references to be used for each test.
   c. Sample copy of equipment and materials inspection form(s).
   d. Sample copy of individual device test form.
   e. Sample copy of individual system test form.
2. Energization Plan: Prior to initial energization of electrical distribution equipment; include the following:
   a. Owner’s representative sign-off form for complete and accurate arc flash labeling and proper protective device settings for equipment to be energized.
   b. Staged sequence of initial energization of electrical equipment.
   c. Lock-Out-Tag-Out plan for each stage of the progressive energization.
   d. Barricading, signage, and communication plan notifying personnel of newly energized equipment.
3. Submit test or inspection reports and certificates for each electrical item tested within 30 days after completion of test:
4. Operation and Maintenance Data:
   a. In accordance with Section 01 78 23, Operation and Maintenance Data.
   b. After test or inspection reports and certificates have been reviewed by Engineer and returned, insert a copy of each in Operation and Maintenance Manual.
5. Programmable Settings: At completion of Performance Demonstration Test, submit final hardcopy printout and electronic files on compact disc of as-left setpoints, programs, and device configuration files for:
   a. Protective relays.
   b. Intelligent overload relays.
   c. Adjustable frequency drives.
   d. Power metering devices.
   e. Uninterruptible power supplies.
   f. Electrical communications modules.

1.03 QUALITY ASSURANCE

A. Testing Firm Qualifications:

1. Corporately and financially independent organization functioning as an unbiased testing authority.
2. Professionally independent of manufacturers, suppliers, and installers of electrical equipment and systems being tested.
3. Employer of engineers and technicians regularly engaged in testing and inspecting of electrical equipment, installations, and systems.
4. Supervising engineer accredited as Certified Electrical Test Technologist by NICET or NETA and having a minimum of 5 years' testing experience on similar projects.
5. Technicians certified by NICET or NETA.
6. Assistants and apprentices assigned to Project at ratio not to exceed two certified to one noncertified assistant or apprentice.
7. Registered Professional Engineer to provide comprehensive Project report outlining services performed, results of such services, recommendations, actions taken, and opinions.
8. In compliance with OSHA CFR 29, Part 1910.7 criteria for accreditation of testing laboratories or a full member company of NETA.

B. Test equipment shall have an operating accuracy equal to or greater than requirements established by NETA ATS.

C. Test Instrument Calibration: In accordance with NETA ATS.

1.04 SEQUENCING AND SCHEDULING

A. Perform inspection and electrical tests after equipment listed herein has been installed.

B. Perform tests with apparatus de-energized whenever feasible.

1. Scheduled with Owner prior to de-energization.
2. Minimized to avoid extended period of interruption to the operating plant equipment.

C. Notify Owner at least 24 hours prior to performing tests on energized electrical equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Perform tests in accordance with requirements of Section 01 91 14, Equipment Testing and Facility Startup.

B. Tests and inspections shall establish:

1. Electrical equipment is operational within industry and manufacturer's tolerances and standards.
2. Installation operates properly.
3. Equipment is suitable for energization.
4. Installation conforms to requirements of Contract Documents and NFPA 70, NFPA 70E, NFPA 101, and IEEE C2.

C. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.

D. Set, test, and calibrate protective relays, circuit breakers, fuses, power monitoring meters, and other applicable devices in accordance with values established by the short circuit, coordination and harmonics studies as specified in Section 26 05 70, Electrical Systems Analysis**.**

E. Adjust mechanisms and moving parts of equipment for free mechanical movement.

F. Adjust and set electromechanical electronic relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

G. Verify nameplate data for conformance to Contract Documents and approved Submittals.

H. Realign equipment not properly aligned and correct unlevelness.

I. Properly anchor electrical equipment found to be inadequately anchored.

J. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench/screw driver to manufacturer's recommendations, or as otherwise specified in NETA ATS.

K. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

L. Provide proper lubrication of applicable moving parts.

M. Inform Engineer of working clearances not in accordance with NFPA 70.

N. Investigate and repair or replace:

1. Electrical items that fail tests.
2. Active components not operating in accordance with manufacturer's instructions.
3. Damaged electrical equipment.

O. Electrical Enclosures:

1. Remove foreign material and moisture from enclosure interior.
2. Vacuum and wipe clean enclosure interior.
3. Remove corrosion found on metal surfaces.
4. Repair or replace, as determined by Engineer door and panel sections having dented surfaces.
5. Repair or replace, as determined by Engineer poor fitting doors and panel sections.
6. Repair or replace improperly operating latching, locking, or interlocking devices.
7. Replace missing or damaged hardware.
8. Finish:
    a. Provide matching paint and touch up scratches and mars.
    b. If required because of extensive damage, as determined by Engineer refinish entire assembly.

P. Replace fuses and circuit breakers that do not conform to size and type required by the Contract Documents or approved Submittals.

3.02 CHECKOUT AND STARTUP

A. Voltage Field Test:

1. Check voltage at point of termination of power company supply system to Project when installation is essentially complete and is in operation.
2. Check voltage amplitude and balance between phases for loaded and unloaded conditions.

3. Record supply voltage (all three phases simultaneously on same graph) for 24 hours during normal working day.
    a. Submit Voltage Field Test Report within 5 days of test.
4. Unbalance Corrections:
    a. Make written request to power company to correct condition if balance (as defined by NEMA) exceeds 1 percent, or if voltage varies throughout the day and from loaded to unloaded condition more than plus or minus 4 percent of nominal.
    b. Obtain written certification from responsible power company official that voltage variations and unbalance are within their normal standards if corrections are not made.

B. Equipment Line Current Tests:

1. Check line current in each phase for each piece of equipment.
2. Make line current check after power company has made final adjustments to supply voltage magnitude or balance.
3. If phase current for a piece of equipment is above rated nameplate current, prepare Equipment Line Phase Current Report that identifies cause of problem and corrective action taken.

3.03 SWITCHBOARD ASSEMBLIES

A. Visual and Mechanical Inspection:

1. Insulator damage and contaminated surfaces.
2. Proper barrier and shutter installation and operation.
3. Proper operation of indicating devices.
4. Improper blockage of air-cooling passages.
5. Proper operation of drawout elements.
6. Integrity and contamination of bus insulation system.
7. Check door and device interlocking system by:
    a. Closure attempt of device when door is in OFF or OPEN position.
    b. Opening attempt of door when device is in ON or CLOSED position.
8. Check key interlocking systems for:
    a. Key captivity when device is in ON or CLOSED position.
    b. Key removal when device is in ON or CLOSED position.
    c. Closure attempt of device when key has been removed.
    d. Correct number of keys in relationship to number of lock cylinders.
    e. Existence of Other Keys Capable of Operating Lock Cylinders: Destroy duplicate sets of keys.

9. Check nameplates for proper identification of:
    a. Equipment title and tag number with latest one-line diagram.
    b. Pushbutton.
    c. Control switch.
    d. Pilot light.
    e. Control relay.
    f. Circuit breaker.
    g. Indicating meter.
10. Verify fuse and circuit breaker ratings, sizes, and types conform to those specified.
11. Check bus and cable connections for high resistance by Low resistance ohmmeter and calibrated torque wrench or thermographic survey applied to bolted joints.
    a. Ohmic value to be zero.
    b. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
    c. Thermographic survey temperature gradient of 2 degrees C, or less.
12. Check operation and sequencing of electrical and mechanical interlock systems by:
    a. Closure attempt for locked open devices.
    b. Opening attempt for locked closed devices.
    c. Key exchange to operate devices in OFF-NORMAL positions.
13. Verify performance of each control device and feature.
14. Control Wiring:
    a. Compare wiring to local and remote control and protective devices with elementary diagrams.
    b. Proper conductor lacing and bundling.
    c. Proper conductor identification.
    d. Proper conductor lugs and connections.
15. Exercise active components.
16. Perform phasing check on double-ended equipment to ensure proper bus phasing from each source.

B. Electrical Tests:

1. Insulation Resistance Tests:
    a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
    b. Each phase of each bus section.
    c. Phase-to-phase and phase-to-ground for 1 minute.
    d. With switches and breakers open.

e. With switches and breakers closed.
f. Control wiring except that connected to solid state components.
g. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.

2. Overpotential Tests:
   a. Applied DC voltage and test procedure in accordance with NEMA PB 2. Alternatively use NETA ATS, Table 100.2.
   b. Each phase of each bus section.
   c. Phase-to-phase and phase-to-ground for 1 minute.
   d. Test results evaluated on a pass/fail basis.
3. Current Injection Tests:
   a. For entire current circuit in each section.
   b. Secondary injection for current flow of 1 ampere.
   c. Test current at each device.
4. Control Wiring:
   a. Apply secondary voltage to control power and potential circuits.
   b. Check voltage levels at each point on terminal boards and each device terminal.
5. Operational Test:
   a. Initiate control devices.
   b. Check proper operation of control system in each section.

3.04 PANELBOARDS

A. Visual and Mechanical Inspection: Include the following inspections and related work:

1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
2. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer’s instruction manual.
3. Check panelboard mounting, area clearances, and alignment and fit of components.
4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer’s instructions for proper torque values.
5. Perform visual and mechanical inspection for overcurrent protective devices.

B. Electrical Tests: Include the following items performed in accordance with manufacturer's instruction:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
   b. Each phase of each bus section.
   c. Phase-to-phase and phase-to-ground for 1 minute.
   d. With switches and breakers open.
   e. With switches and breakers closed.
   f. Control wiring except that connected to solid state components.
   g. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
2. Ground continuity test ground bus to system ground.

3.05 DRY TYPE TRANSFORMERS

A. Visual and Mechanical Inspection:

1. Physical and insulator damage.
2. Proper winding connections.
3. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
4. Defective wiring.
5. Proper operation of fans, indicators, and auxiliary devices.
6. Removal of shipping brackets, fixtures, or bracing.
7. Free and properly installed resilient mounts.
8. Cleanliness and improper blockage of ventilation passages.
9. Verify tap-changer is set at correct ratio for rated output voltage under normal operating conditions.
10. Verify proper secondary voltage phase-to-phase and phase-to-ground after energization and prior to loading.

B. Electrical Tests:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.5 for each:
      1) Winding-to-winding.
      2) Winding-to-ground.
   b. Test Duration: 10 minutes with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
   c. Results temperature corrected in accordance with NETA ATS, Table 100.14.

d. Temperature corrected insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
e. Insulation resistance test results to compare within 1 percent of adjacent windings.

2. Perform tests and adjustments for fans, controls, and alarm functions as suggested by manufacturer.

3.06 LOW VOLTAGE CABLES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Inspect each individual exposed power cable No. 4 and larger for:
   a. Physical damage.
   b. Proper connections in accordance with single-line diagram.
   c. Cable bends not in conformance with manufacturer's minimum allowable bending radius where applicable.
   d. Color coding conformance with specification.
   e. Proper circuit identification.
2. Mechanical Connections for:
   a. Proper lug type for conductor material.
   b. Proper lug installation.
   c. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
3. Shielded Instrumentation Cables for:
   a. Proper shield grounding.
   b. Proper terminations.
   c. Proper circuit identification.
4. Control Cables for:
   a. Proper termination.
   b. Proper circuit identification.
5. Cables Terminated Through Window Type CTs: Verify neutrals and grounds are terminated for correct operation of protective devices.

B. Electrical Tests for Conductors No. 4 and Larger:

1. Insulation Resistance Tests:
   a. Utilize 1,000-volt dc megohmmeter for 600-volt insulated conductors.
   b. Test each conductor with respect to ground and to adjacent conductors for 1 minute.
   c. Evaluate ohmic values by comparison with conductors of same length and type.
   d. Investigate values less than 50 megohms.

2. Continuity test by ohmmeter method to ensure proper cable connections.

3.07 SAFETY SWITCHES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Proper blade pressure and alignment.
2. Proper operation of switch operating handle.
3. Adequate mechanical support for each fuse.
4. Proper contact-to-contact tightness between fuse clip and fuse.
5. Cable connection bolt torque level in accordance with NETA ATS, Table 100.12.
6. Proper phase barrier material and installation.
7. Verify fuse sizes and types correspond to one-line diagram or approved Submittals.
8. Perform mechanical operational test and verify electrical and mechanical interlocking system operation and sequencing.

B. Electrical Tests:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
   b. Phase-to-phase and phase-to-ground for 1 minute on each pole.
   c. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
2. Contact Resistance Tests:
   a. Contact resistance in microhms across each switch blade and fuse holder.
   b. Investigate deviation of 50 percent or more from adjacent poles or similar switches.

3.08 MEDIUM-VOLTAGE METAL-ENCLOSED AIR SWITCHES

A. Visual and Mechanical Inspection:

1. Proper blade pressure, alignment, and arch interrupter operation.
2. Proper operation of operating mechanism.
3. Proper contact condition.
4. Adequate mechanical support for each fuse.
5. Proper contact-to-contact tightness between fuse clip and fuse.
6. Bus and cable connection tightness.
7. Proper phase barrier material and installation.
8. Proper operation of indicating devices.

9. Installation of expulsion limiting devices on expulsion type element holders.
10. Verify fuse links and types correspond to one-line diagram or approved Submittals.
11. Perform mechanical operational test to verify electrical and mechanical interlocking system operation and sequencing.
12. Perform phasing check on double-ended air switch arrangements to ensure proper bus phasing from each source.

B. Electrical Tests:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
   b. Phase-to-phase and phase-to-ground for 1 minute on each pole.
   c. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
2. Contact Resistance Tests:
   a. Contact resistance in microhms across each switch blade and fuse holder.
   b. Investigate values exceeding 500 microhms or deviation of 50 percent or more from adjacent poles or similar switches.
3. Overpotential Tests:
   a. Applied dc voltage in accordance with NETA ATS, Table 100.19.
   b. Phase-to-phase and phase-to-ground for 1 minute.
   c. Test results evaluated on pass/fail basis.

3.09 MOLDED AND INSULATED CASE CIRCUIT BREAKERS

A. General: Inspection and testing limited to circuit breakers rated 100 amperes and larger and to motor circuit protector breakers rated 50 amperes and larger.

B. Visual and Mechanical Inspection:

1. Proper mounting.
2. Proper conductor size.
3. Feeder designation according to nameplate and one-line diagram.
4. Cracked casings.
5. Connection bolt torque level in accordance with NETA ATS, Table 100.12.
6. Operate breaker to verify smooth operation.
7. Compare frame size and trip setting with circuit breaker schedules or one-line diagram.

8. Verify that terminals are suitable for 75 degrees C rated insulated conductors.

C. Electrical Tests:

1. Insulation Resistance Tests:
   a. Utilize 1,000-volt dc megohmmeter for 480-volt and 600-volt circuit breakers.
   b. Pole-to-pole and pole-to-ground with breaker contacts opened for 1 minute.
   c. Pole-to-pole and pole-to-ground with breaker contacts closed for 1 minute.
   d. Test values to comply with NETA ATS, Table 100.1.
2. Contact Resistance Tests:
   a. Contact resistance in microhms across each pole.
   b. Investigate deviation of 50 percent or more from adjacent poles and similar breakers.
3. Primary Current Injection Test to Verify:
   a. Long-time minimum pickup and delay.
   b. Short-time pickup and delay.
   c. Ground fault pickup and delay.
   d. Instantaneous pickup by run-up or pulse method.
   e. Trip characteristics of adjustable trip breakers shall be within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
   f. Trip times shall be within limits established by NEMA AB 4, Table 5-3. Alternatively, use NETA ATS, Table 100.7.
   g. Instantaneous pickup value shall be within values established by NEMA AB 4, Table 5-4. Alternatively, use NETA ATS, Table 100.8.

3.10 LOW VOLTAGE POWER CIRCUIT BREAKERS

A. Visual and Mechanical Inspection:

1. Proper mounting, cell fit, and element alignment.
2. Proper operation of racking interlocks.
3. Check for damaged arc chutes.
4. Proper contact condition.
5. Bolt torque level in accordance with NETA ATS, Table 100.12.
6. Perform mechanical operational and contact alignment tests in accordance with manufacturer's instructions.

7. Check operation of closing and tripping functions of trip devices by activating ground fault relays, undervoltage shunt relays, and other auxiliary protective devices.
8. Verify primary and secondary contact wipe, gap setting, and other dimensions vital to breaker operation are correct.
9. Check charging motor, motor brushes, associated mechanism, and limit switches for proper operation and condition.
10. Check operation of electrically operated breakers in accordance with manufacturer's instructions.
11. Check for adequate lubrication on contact, moving, and sliding surfaces.

B. Electrical Tests:

1. Insulation Resistance Tests:
   a. Utilize 1,000-volt dc megohmmeter for 480-volt and 600-volt circuit breakers.
   b. Pole-to-pole and pole-to-ground with breaker contacts opened for 1 minute.
   c. Pole-to-pole and pole-to-ground with breaker contacts closed for 1 minute.
   d. Test values to comply with NETA ATS, Table 100.1.
2. Contact Resistance Tests:
   a. Contact resistance in microhms across each pole.
   b. Investigate deviation of 50 percent or more from adjacent poles and similar breakers.
3. Primary Current Injection Test to Verify:
   a. Long-time minimum pickup and delay.
   b. Short-time pickup and delay.
   c. Ground fault pickup and delay.
   d. Instantaneous pickup by run-up or pulse method.
   e. Trip characteristic when adjusted to setting sheet parameters shall be within manufacturer's published time-current tolerance band.

3.11 PROTECTIVE RELAYS

A. Visual and Mechanical Inspection:

1. Visually check each relay for:
   a. Tight cover gasket and proper seal.
   b. Unbroken cover glass.
   c. Condition of spiral spring and contacts.
   d. Disc clearance.
   e. Condition of case shorting contacts if present.
2. Mechanically check each relay for:
   a. Freedom of movement.
   b. Proper travel and alignment.

3. Verify each relay:
    a. Complies with Contract Documents, approved Submittal, and application.
    b. Is set in accordance with recommended settings from Coordination Study.

B. Electrical Tests:

1. Insulation resistance test on each circuit to frame, except for solid state devices.
2. Test on nominal recommended setting for:
    a. Pickup parameters on each operating element.
    b. Timing at three points on time-current curve.
    c. Pickup target and seal-in units.
    d. Special tests as required to check operation of restraint, directional, and other elements in accordance with manufacturer's instruction manual.
3. Phase angle and magnitude contribution tests on differential and directional relays after energization to vectorially verify proper polarity and connections.
4. Current Injection Tests:
    a. For entire current circuit in each section.
    b. Secondary injection for current flow of 1 ampere.
    c. Test current at each device.

3.12 INSTRUMENT TRANSFORMERS

A. Visual and Mechanical Inspection:

1. Visually check current, potential, and control transformers for:
    a. Cracked insulation.
    b. Broken leads or defective wiring.
    c. Proper connections.
    d. Adequate clearances between primary and secondary circuit wiring.
2. Verify Mechanically:
    a. Grounding and shorting connections have good contact.
    b. Withdrawal mechanism and grounding operation, when applicable, operate properly.
3. Verify proper primary and secondary fuse sizes for potential transformers.

B. Electrical Tests:

1. Current Transformer Tests:

a. Insulation resistance test of transformer and wiring-to-ground at 1,000 volts dc for 30 seconds.
b. Polarity test.
c. Ratio and accuracy test.

2. Potential Transformer Tests:
   a. Insulation resistance test at test voltages in accordance with NETA ATS, Table 100.9, for 1 minute on:
      1) Winding-to-winding.
      2) Winding-to-ground.
   b. Polarity test to verify polarity marks or H1-X1 relationship as applicable.
   c. Ratio and accuracy test.
3. Insulation resistance measurement on instrument transformer shall not be less than that shown in NETA ATS, Table 100.5.

3.13 METERING

A. Visual and Mechanical Inspection:

1. Verify meter connections in accordance with appropriate diagrams.
2. Verify meter multipliers.
3. Verify meter types and scales conform to Contract Documents.
4. Check calibration of meters at cardinal points.
5. Check calibration of electrical transducers.

3.14 GROUNDING SYSTEMS

A. Visual and Mechanical Inspection:

1. Equipment and circuit grounds in motor control center, panelboard, and switchboard assemblies for proper connection and tightness.
2. Ground bus connections in motor control center, panelboard, and switchboard assemblies for proper termination and tightness.
3. Effective transformer core and equipment grounding.
4. Accessible connections to grounding electrodes for proper fit and tightness.
5. Accessible exothermic-weld grounding connections to verify that molds were fully filled and proper bonding was obtained.

B. Electrical Tests:

1. Fall-of-Potential Test:
   a. In accordance with IEEE 81, Section 8.2.1.5 for measurement of main ground system’s resistance.

b. Main ground electrode system resistance to ground to be no greater than 3 ohm(s).

2. Two-Point Direct Method Test:
   a. In accordance with IEEE 81, Section 8.2.1.1 for measurement of ground resistance between main ground system, equipment frames, and system neutral and derived neutral points.
   b. Equipment ground resistance shall not exceed main ground system resistance by 0.25 ohm.

3.15 GROUND FAULT SYSTEMS

A. Inspection and testing limited to:

1. Zero sequence grounding systems.
2. Residual ground fault systems.

B. Visual and Manual Inspection:

1. Neutral main bonding connection to ensure:
   a. Zero sequence sensing system is grounded ahead of neutral disconnect link.
   b. Ground strap sensing system is grounded through sensing device.
   c. Neutral ground conductor is solidly grounded.
2. Verify control power has adequate capacity for system.
3. Manually operate monitor panels for:
   a. Trip test.
   b. No trip test.
   c. Nonautomatic rest.
4. Zero sequence system for symmetrical alignment of core balance transformers about current carrying conductors.
5. Relay check for pickup and time under simulated ground fault conditions.
6. Verify nameplate identification by device operation.

C. Electrical Tests:

1. Test system neutral insulation resistance with neutral ground link removed; minimum 1 megohm.
2. Determine relay pickup by primary current injection at the sensor. Relay pickup current within plus or minus 10 percent of device dial or fixed setting.
3. Test relay timing by injecting 300 percent of pick-up current or as specified by manufacturer. Relay operating time in accordance with manufacturer’s time-current characteristic curves.
4. Test system operation at 55 percent rated control voltage, if applicable.

5. Test zone interlock system by simultaneous sensor current injection and monitoring zone blocking functions.

3.16 AC INDUCTION MOTORS

A. General: Inspection and testing limited to motors rated 1 horsepower and larger.

B. Visual and Mechanical Inspection:

1. Proper electrical and grounding connections.
2. Shaft alignment.
3. Blockage of ventilating air passageways.
4. Operate motor and check for:
   a. Excessive mechanical and electrical noise.
   b. Overheating.
   c. Correct rotation.
   d. Check vibration detectors, resistance temperature detectors, or motor inherent protectors for functionability and proper operation.
   e. Excessive vibration, in excess of values in NETA ATS, Table 100.10.
5. Check operation of space heaters.

C. Electrical Tests:

1. Insulation Resistance Tests:
   a. In accordance with IEEE 43 at test voltages established by NETA ATS, Table 100.1 for:
      1) Motors above 200 horsepower for 10-minute duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
      2) Motors 200 horsepower and less for 1-minute duration with resistances tabulated at 30 seconds and 60 seconds.
   b. Insulation resistance values equal to, or greater than, ohmic values established by manufacturers.
2. Calculate polarization index ratios for motors above 200 horsepower. Investigate index ratios less than 1.5 for Class A insulation and 2.0 for Class B insulation.
3. Insulation resistance test on insulated bearings in accordance with manufacturer’s instructions.
4. Measure running current and voltage, and evaluate relative to load conditions and nameplate full-load amperes.

3.17 LOW-VOLTAGE MOTOR CONTROL

A. Visual and Mechanical Inspection:

1. Proper barrier and shutter installation and operation.
2. Proper operation of indicating and monitoring devices.
3. Proper overload protection for each motor.
4. Improper blockage of air-cooling passages.
5. Proper operation of drawout elements.
6. Integrity and contamination of bus insulation system.
7. Check door and device interlocking system by:
    a. Closure attempt of device when door is in OFF or OPEN position.
    b. Opening attempt of door when device is in ON or CLOSED position.
8. Check key interlocking systems for:
    a. Key captivity when device is in ON or CLOSED position.
    b. Key removal when device is in OFF or OPEN position.
    c. Closure attempt of device when key has been removed.
    d. Correct number of keys in relationship to number of lock cylinders.
    e. Existence of other keys capable of operating lock cylinders; destroy duplicate sets of keys.
9. Check nameplates for proper identification of:
    a. Equipment title and tag number with latest one-line diagram.
    b. Pushbuttons.
    c. Control switches.
    d. Pilot lights.
    e. Control relays.
    f. Circuit breakers.
    g. Indicating meters.
10. Verify fuse and circuit breaker sizes and types conform to Contract Documents.
11. Verify current and potential transformer ratios conform to Contract Documents.
12. Check bus connections for high resistance by low resistance ohmmeter and calibrated torque wrench applied to bolted joints or thermographic survey.
    a. Ohmic value to be zero.
    b. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
    c. Thermographic survey temperature gradient of 2 degrees C, or less per NETA ATS, Table 100.18.
13. Check operation and sequencing of electrical and mechanical interlock systems by:

a. Closure attempt for locked open devices.
b. Opening attempt for locked closed devices.
c. Key exchange to operate devices in OFF-NORMAL positions.

14. Verify performance of each control device and feature furnished as part of motor control center.
15. Control Wiring:
    a. Compare wiring to local and remote control, and protective devices with elementary diagrams.
    b. Check for proper conductor lacing and bundling.
    c. Check for proper conductor identification.
    d. Check for proper conductor lugs and connections.
16. Exercise active components.
17. Inspect contactors for:
    a. Correct mechanical operations.
    b. Correct contact gap, wipe, alignment, and pressure.
    c. Correct torque of connections.
18. Compare overload heater rating with full-load current for proper size.
19. Perform phasing check on double-ended motor control centers to ensure proper bus phasing from each source.

B. Electrical Tests:

1. Insulation Resistance Tests:
    a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
    b. Bus section phase-to-phase and phase-to-ground for 1 minute on each phase.
    c. Contactor phase-to-ground and across open contacts for 1 minute on each phase.
    d. Starter section phase-to-phase and phase-to-ground on each phase with starter contacts closed and protective devices open.
    e. Test values to comply with NETA ATS, Table 100.1.
2. Current Injection through Overload Unit at 300 Percent of Motor Full-Load Current and Monitor Trip Time:
    a. Trip time in accordance with manufacturer’s published data.
    b. Investigate values in excess of 120 seconds.
3. Control Wiring Tests:
    a. Apply secondary voltage to control power and potential circuits.
    b. Check voltage levels at each point on terminal board and each device terminal.
    c. Insulation resistance test at 1,000 volts dc on control wiring, except that connected to solid state components; 1 megohm minimum insulation resistance.
4. Operational test by initiating control devices to affect proper operation.

3.18 LOW VOLTAGE SURGE ARRESTORS

A. Visual and Mechanical Inspection:

1. Adequate clearances between arrestors and enclosures.
2. Ground connections to ground bus.

B. Electrical Tests:

1. Varistor Type Arrestors:
   a. Clamping voltage test.
   b. Rated RMS voltage test.
   c. Rated dc voltage test.
   d. Varistor arrestor test values in accordance with IEEE C62.33, Section 4.4 and Section 4.9.

3.19 UNINTERRUPTIBLE POWER SUPPLIES (UPS)

A. UPS Start-up Inspection and Testing:

1. Visual Inspection:
   a. Inspect equipment for signs of damage.
   b. Verify installation per Drawings.
   c. Inspect cabinets for foreign objects.
   d. Verify neutral and ground conductors are properly sized and configured per vendor requirements as noted in vendor drawings supplied with installation manuals or submittal package.
   e. Inspect all battery cell cases.
   f. Inspect each cell for proper polarity.
2. Mechanical Inspection:
   a. Check all control wiring connections for tightness.
   b. Check all power wiring connections for tightness.
   c. Check all terminal screws, nuts, and spade lugs for tightness.
3. Electrical Inspection:
   a. Check all fuses for continuity.
   b. Confirm input bypass voltage and phase rotation is correct.
   c. Verify control transformer connections are correct for voltages being used.
   d. Assure connections and voltage of the battery string(s).
   e. Battery inspection and certification according to IEEE standards.
4. Unit Start-Up:
   a. Energize control power.
   b. Perform control/logic checks and adjust to meet manufacturer specification.

c. Verify DC float and equalize voltage levels.
d. Verify DC voltage clamp and over-voltage shutdown levels.
e. Verify battery discharge, low-battery warning, and low-battery shutdown levels.
f. Verify fuse monitor alarms and system shutdown.
g. Verify inverter voltages and regulation circuits.
h. Verify inverter/bypass sync circuits and set overlap time.
i. Perform manual transfers and returns.
j. Simulate utility outage at no load.
k. Verify proper recharge.

B. Provide test instruments to record elapsed time between transfers, voltage, current, frequency, waveform, and transients.

1. Include services of an experienced technician to make final adjustments, final connections, and perform final testing.
2. Evidence of transients or phase shifts in graphs will be cause for rejection of system.

C. Provide load bank of rating equal to actual load if actual load is not available. Test total system at full load for rated time of system by simulating:

1. Utility power failure all three phases, one phase.
2. Inverter failure off line.
3. Inverter failure on line.
4. Battery failure.

3.20 THERMOGRAPHIC SURVEY

A. Provide thermographic survey per NETA ATS Table 100.18 of connections associated with incoming service conductors, bus work, and branch feeder conductors No. 4 and larger at each:

1. Switchboard.
2. Low voltage motor control center.
3. Panelboard.

B. Provide thermographic survey of feeder conductors No. 4 and larger terminating at:

1. Motors rated 50 hp and larger.
2. Low voltage disconnect switches.

C. Remove necessary enclosure metal panels and covers prior to performing survey.

D. Perform with equipment energized during periods of maximum possible loading per NFPA 70B, Section 20.17.

E. Do not perform survey on equipment operating at less than 20 percent of rated load. If plant load is insufficient, perform test with supplemental load bank producing rated load on item being measured.

F. Use thermographic equipment capable of:

1. Detecting emitted radiation.
2. Converting detected radiation to visual signal.
3. Detecting 1 degree C temperature difference between subject area and reference point of 30 degrees C.

G. Temperature Gradients:

1. 3 degrees C to 7 degrees C indicates possible deficiency that warrants investigation.
2. 7 degrees C to 15 degrees C indicates deficiency that is to be corrected as time permits.
3. 16 degrees C and above indicates deficiency that is to be corrected immediately.

H. Provide written report of:

1. Areas surveyed and the resultant temperature gradients.
2. Locations of areas having temperature gradients of 3 degrees C or greater.
3. Cause of heat rise and actions taken to correct cause of heat rise.
4. Detected phase unbalance.

END OF SECTION

2.13 AUTO THROW OVER (ATO) CONTROLS

A. General: Redundant PLC based control module to sense utility and generator power and open and close main, tie and generator circuit breakers as shown on the Drawings and report status to plant SCADA system.

B. Programmable Logic Controllers (PLC):

1. Solid state units capable of performing same function as conventional relays, timers, counters, drum sequencers, arithmetic, and other special functions necessary to perform required control functions.
2. Memory: 1MB, minimum. Size processor such that there is a minimum of 30 percent spare memory available. Include manufacturer's standard SD memory card for each CPU module.
3. I/O Modules: Optical isolations rated at 2,500-volt rms. Discrete outputs shall be rated for 2 amps at 120V ac. Each input and output shall have an LED ON/OFF status indicator.
4. Minimum of 25 percent excess capacity for inputs, outputs, internal coils, registers, and other necessary functions.
5. Capable of operating in a hostile industrial environment (for example, heat, electrical transients, RFI, and vibration) without fans, air conditioning, or electrical filtering. Units operate from 0 to 60 degrees C and up to 95 percent humidity, noncondensing.
6. Provide redundant processors to provide automatic fail-over between CPU modules as a hot standby system. Provide manufacturer's standard redundancy cable between CPU devices. Redundant PLC racks shall be powered from separate power supplies.
7. Communications: Provide on-board CPU or chassis mounted communications modules as required for all network interfaces as specified or as shown in the Drawings.
    a. Standard Ethernet protocol to networked switchboard devices, such as smart relays, shall be Modbus TCP.
    b. Communications are required between the switchboard control system and the existing facility SCADA system for remote monitoring of electrical equipment status as shown on the Drawing 06-E-6001 and 08-N-7002. At minimum, provide the following tagged data in the switchboard PLC system to be read by the facility SCADA HMI:
        1) Communications watchdog status. Provide a loss of communications alarm for any data link failure between the switchboard PLC and networked devices.
        2) Generator run status.
        3) Generator fault status.
        4) Generator auto/not in auto status.
        5) Generator fuel level.

6) Display the current fuel level in both engineering units as well as a percentage of the tank capacity to allow operators to determine how much fuel is left.
7) Provide a low fuel level alarm if the measured tank level drops below an operator-specified threshold.
8) Generator fuel leak alarm.
9) Generator number of starts.
10) Generator runtime.
11) Utility bus power status.
12) Generator bus power status.
13) Switchboard general fault status.

8. Manufacturers:
   a. Schneider Electric; Modicon M580 PAC Series with X80 I/O Modules.

C. Operator Interface Terminal (OIT):

1. Provide a panel-mounted OIT on the front face of the control section enclosure. OIT shall be interfaced to the switchboard PLC via Modbus TCP Ethernet data link and display live status of all breakers, power measurement values, and faults for the switchboard and generator systems.
2. Capable of operating in a hostile industrial environment (for example, heat, electrical transients, RFI, and vibration) without fans, air conditioning, or electrical filtering. Units operate from 0 to 50 degrees C and up to 90 percent humidity, noncondensing.
3. Screen Size: 10 inches, unless otherwise noted or shown.
4. Display Type: Multicolor TFT LCD with ASCII character font.
5. Touchpad capability included.
6. NEMA 4 ingress rating.
7. Operating voltage: 24V dc, unless otherwise noted or shown.
8. Manufacturer: Schneider Electric; Harmony ST6 Series.

D. The Auto Throw Over (ATO) System shall be designed for the following modes of control operation:

1. Automatic.
2. Off.
3. Test.
4. Manual.

E. A four-position selector switch (AUTS) shall be provided for selecting any of the operational modes specified above. When the AUTS switch is locked in the off position, the generator cannot be operated or started. The Auto, Test, and Manual modes of operation are specified as follows:

1. AUTS in “Automatic” Position: When the AUTS switch is in AUTO position the generator system shall be set for automatic operation, and open transition load assumption and return. Normal Condition being Main Breaker M1 and Tie Breaker T1 are CLOSED. Generator Breaker G1 is OPEN. There are four different scenarios within the automatic operation as follows:
    a. When Utility source fails:
        1) When UTILITY source fails, and the AUTS switch is in the “automatic” position, OPEN the main breaker (M1) of the failed source and lock this breaker in the OPEN position, until such time that the PLC calls for CLOSING the breaker.
        2) When confirmation is received at the PLC that main breaker (M1) is OPEN, the PLC issues a START engine command to the generator. The engine “START” command shall be a contact closure sent to the locally mounted engine control panels (ECPS).
        3) CLOSE the generator output circuit breaker G1 after the generator reaches operating voltage and frequency.
        4) The engine generator shall assume the majority of the plant load in the first step with remain plant load being added in additional steps. During operation the generator control system shall regulate the output power of the engine generator so that it never exceeds the actual feeder loads connected to bus “A”, bus “B”, or both buses “A” and “B”.
    b. When Utility Source returns:
        1) When the UTILITY source returns, and the AUTS switch is in the “automatic” position, after a predetermined time (minimum 5 minutes after utility source is verified to be stable, providing time for the SCADA system to reduce the generator loading), the PLC shall initiate an “Open transition return to the utility” sequence as described in the following steps:
            a) Generator breaker G1 shall OPEN. When confirmation is received at the PLC that Generator breaker G1 is OPEN the PLC issues a CLOSE command to Main breaker M1.
            b) The generator shall run for an adjustable cool down period of 5 to 40 minutes before shutdown.
2. AUTS in “Test” Position:
    a. A three-position LOAD selector switch shall be provided for selection between both Buses “A” and “B”, Bus “B” or No Load.

b. When the AUTS is in the "Test" position, the LOAD selector switch is in the NO-LOAD position, the following test shall be preformed:
   1) When the operator enters a "start" signal at the PLC operator interface panel, implement the following sequence:
      a) Issue START command to generator. The engine START command is a contact closure to the locally mounted engine control panel (ECP).
      b) Verify that the Generator Breaker (G1) is open. Bring the generator up to operating voltage and frequency. generator breaker (G1) Remains Open, At this point the generator shall be running at no load,
   2) When the operator enters a "stop" signal through the PLC operator interface panel, G1 shall remain open and the generator shall be shut down following an adjustable cool down period.

c. When the AUTS is in the "Test" position, the LOAD selector switch is in the Both Bus "A" & Bus "B" position, the following test shall be performed:
   1) When the operator enters a "start" signal at the PLC operator interface panel, implement the following sequence:
      a) OPEN the main breaker (M1) and lock this breaker in the OPEN position, until such time that the PLC calls for CLOSING this breaker.
      b) Issue START command to generator. The engine START command is a contact closure to the locally mounted engine control panel (ECP).
      c) Make sure that the Main Breaker (M1) is Open. Bring the generator to operating voltage and frequency. Close generator breaker (G1).
   2) When the operator enters a "stop" signal through the PLC operator interface panel, implement the following sequence:
      a) Generator Breaker (G1) shall open. When confirmation is received at the PLC that generator breaker is OPEN, the PLC issues a CLOSE command to main breaker M1.
      b) The generator shall run for an adjustable cool down period of 5 to 40 minutes before shutdown.

d. When the AUTS is in the "Test" position, the LOAD selector switch is in the Bus "B" position, the following test shall be performed:
   1) When the operator enters a "start" signal at the PLC operator interface panel, implement the following sequence:
      a) OPEN the tie breaker (T1) and lock this breaker in the OPEN position, until such time that the PLC calls for CLOSING this breaker.

b) Issue START command to generator. The engine START command is a contact closure to the locally mounted engine control panel (ECP).
c) Make sure that the Tie Breaker (T1) is Open. Bring the generator to operating voltage and frequency. Close generator breaker (G1).

2) When the operator enters a "stop" signal through the PLC operator interface panel, implement the following sequence:
a) Generator Breaker (G1) shall open. When confirmation is received at the PLC that generator breaker is OPEN, the PLC issues a CLOSE command to Tie breaker (T1).
b) The generator shall run for an adjustable cool down period of 5 to 40 minutes before shutdown.

3. AUTS in "Manual" Position: When this switch is in Manual position the entire operation is strictly manual (open transition) bypassing the PLC and utilizing the backup electromechanical system to implement the following functions (MANUALLY):
a. Start generator system.
b. OPEN utility main breaker.
c. Close the generator breaker.
d. CLOSE tie-breaker (if open).
e. The entire OPEN transition assumption of load and return to utility shall be manually feasible. Provide all safety interlocks for safe manual operation. The main, tie and generator circuit breakers shall be electrical interlocked to prevent parallel connection of the incoming source with the generator.
f. In manual mode, individual breaker control switch (CS), engine control switches (ECS), speed controls, and voltage adjusting rheostats shall be used to perform required functions.

F. Plug-in, industrial grade interfacing relays with dust covers.

G. Plug-in printed circuit boards for sensing and control logic.

H. Adjustable solid state undervoltage sensors for all three phases of utility and of standby source:

1. Pickup 85 to 100 percent nominal.
2. Dropout 75 to 98 percent of pickup setting.

I. Adjustable frequency sensors for standby source:

1. Pickup 90 to 100 percent nominal.
2. Dropout 87 to 89 percent of pickup setting.

J. Control module with adjustable time delays:

1. 0.5- to 6-second engine start delay.
2. 0- to 5-minute load transfer to emergency delay.
3. 0- to 30-minute retransfer to normal delay.
4. 0- to 30-minute unload running time delay.
5. Switch to bypass any of the above time delays during testing.

K. Form-C start contacts, rated 10 amperes, 32-volt dc, for two-wire engine control, wired to terminal block.

L. Exerciser, adjustable in 15-minute increments, 7-day dial clock to automatically exercise generator without load transfer and simulate normal power failure and transfer load to generator, complete with door mounted NO LOAD and LOAD selector switch.

M. Accessory Power: From 24V dc UPS integrally mounted and powered from the switchgear and backup 24V dc from generator batteries to ensure that control power is available to the microprocessor and protective device accessories. Refer to the P&ID Drawings for additional interface requirements.

N. Switchboard network communication:

1. Switchboard ATO PLC and power meters shall be equipped with communication interface to allow remote monitoring from the Plant SCADA system.
2. Communication shall be Ethernet.
3. The switchboard shall provide a single point of interface with the SCADA system. Provide necessary communication card for single point interface with SCADA. Any communication card required shall be factory installed, wired and tested by vendor.
4. All communication cabling shall be factory installed, connected and factory tested.
5. Coordinate data exchange from the ATO PLC and power meters to the Plant Control System with PICS Subcontractor.
    a. Specified data shall be mapped into user map variables to optimize communications.
    b. Provide PIC Subcontractor with the network address of all device and mapping of data in the device at least two week prior to factory testing of the switchgear. Mapping shall use tags used on single-line diagrams.
6. Communication within switchgear shall be configured so network is not lost when a device is removed from the system.

O. Loss of Single Normal Utility Source:

Steps in Sequence		Utility Main Breaker	Tie Breaker	Generator Breaker	Gen Run Signal
0	Initial state	C	C	O	
1	Loss of utility is detected by PLC				
2	PLC starts Transfer Timer				
3	After Timer expires, the PLC starts the generator delay timer, and opens the utility main breaker	O			
4	After Generator timer expires, the PLC will send a run command to the generator				*
5	PLC confirms generator is at acceptable range and closes the generator breaker. Switchboard is fed from standby generator			C	*
6	Load can operate from Standby Power. State of system after transfer	O	C	C	*

P. Return of Failed Utility:

Steps in Sequence		Utility Main Breaker	Tie Breaker	Generator Breaker	Gen Run Signal
0	Initial State	O	C	C	*
1	PLC detects Utility has been restored				*
2	PLC starts retransfer delay timer				*
3	After retransfer delay timer has expired, the PLC opens the generator breaker			O	*
4	PLC starts cooldown time				*

Steps in Sequence		Utility Main Breaker	Tie Breaker	Generator Breaker	Gen Run Signal
5	PLC closed utility main breaker	C	C	O	
6	After generator cool down, PLC deactivates start command				
7	State after transfer	C	C	O	

Q. Manual Mode: When the mode selector switch is in MANUAL position, the PLC will not perform any operation on the main, tie or generator breakers. Control of these breakers will be performed locally at each breaker via breakers control switch.

R. Manual Transfer from a Single Normal Source to Standby Generator:

Steps in Sequence		Utility Main Breaker	Tie Breaker	Generator Breaker	Gen Run Signal
0	Initial State	C	C	O	
1	Selector switch is places in MANUAL mode				
2	Operator sends run signal from generator switch located at switchboard				*
3	Operator confirms that Generator Voltage and frequency are acceptable via HMI screen on switchboard				*
4	Operator opens utility breaker via breaker control switch	O			*
5	Once utility breaker is open, the operator uses breaker control switch on generator breaker to close it	O	C	C	*
6	Generator is now supplying power to the entire switch board				*
7	State after transfer	O	C	C	*

S. Manual Transfer from Standby Generator to Single Normal Source:

Steps in Sequence		Utility Main Breaker	Tie Breaker	Generator Breaker	Gen Run Signal
0	Initial State	O	C	C	*
1	Selector switch is places in MANUAL mode. Operator confirms that utility power has been restored by monitoring the voltage and frequency in the HMI screen				*
2	Operator used the control switch to open the generator breaker	O	C	O	*
3	Operator will wait for the generator cool down period before placing the generator switch in the OFF position				*
4	Operator closes utility breaker via breaker control switch	C	C	O	
5	Operator verifies that the switchboard is back to normal mode. Switch can be placed back into AUTO mode				
6	State after transfer	C	C	O	

2.14 INTERLOCKS

A. The main, tie and generator circuit breakers shall be electrical interlocked to prevent parallel connection of the incoming utility source with the generator (interlocking through the PLC only will not be acceptable).

1. Interlocks shall prevent:
   a. CLOSING Generator breaker GEN unless main breaker MAIN is OPEN or tie breaker TIE is OPEN.
   b. CLOSING main breaker MAIN unless generator breaker GEN is OPEN or tie breaker TIE is OPEN.

2.15 FACTORY TESTING (REPLACES EXISTING 2.13)

A. Factory Testing:

1. Applicable Standards: ANSI/IEEE C37.20.1.
2. Perform standard factory inspection and tests in accordance with ANSI and NEMA requirements to verify components have been designed to specification, assembled in accordance with applicable standards, and each unit functions in accordance with electrical diagrams.
3. Actual operation shall be performed wherever possible. Otherwise, inspect and perform continuity checks.
4. Verify component devices operated correctly in circuits as shown on diagrams or as called for in Specifications.
5. Control Circuits and Devices:
    a. Energize circuit at rated voltage.
    b. Operate control devices.
    c. Perform continuity check.
6. Instruments, Meters, Protective Relays, and Equipment:
    a. Verify devices functioned by energizing potential to rated values with connection to devices made at outgoing terminal blocks.
    b. Verify protective relays operated for functional checks and trips manually initiated to verify functioning of operation for indicator and associated circuits.
7. Perform dielectric tests on primary circuits and equipment, except potential transformers. Tests shall be made phase-to-phase and phase to around with 60-cycle test voltages applied for 1 second at 2,640 volts.
8. Verify equipment passed tests and inspection.
9. Provide standard factory inspection and test checklists and final certified and signed test report.
10. As part of the factory test, the internal data link shall be tested and checked out using a laptop/test PLC with appropriate software and interfaces installed.
11. The test laptop/PLC, hardware and software shall be furnished by switchgear vendor.
12. PICS Interface Test:
    a. The PICS supplier will provide a Profibus DP master to be connected to the switchgear.
    b. The switchgear shall be energized.
    c. For the ATO PLC and power metering, the PICS supplier will check for proper data exchange with the Profibus DP master related for all data specified.
    d. Submit a factory test plan for approval which includes data exchange table for SCADA communication testing. An approved test plan is a prerequisite to conducting factory testing.

13. Submit a factory test plan for approval which includes data exchange table for SCADA communication testing. An approved test plan is a prerequisite to conducting factory testing.
14. Submit a factory test plan for approval which includes data exchange table for SCADA communication testing. An approved test plan is a prerequisite to conducting factory testing.

MATCHLINE SEE 05-E-2002

0 30 60 90
1" = 30'

C42 HANDHOLE 2'X2' C42
C35
EXISTING MANHOLE
P17
57 - SLUDGE TRANSFER BUILDING
MCC8 (EXISTING)
L7
EXISTING HANDHOLE
C36
C36
57-SWP-01
EXISTING HANDHOLE
C37
P16
EXISTING MANHOLE
59-SWP-01
C20
MAINTENANCE BUILDING TRANSFORMER (EXISTING)
PANEL MB1 (EXISTING)
PANEL MB2 (EXISTING)
EXISTING HANDHOLE
1 C19
CP01-SWP-01
P15
P14
EXISTING MANHOLE
MCC3 (EXISTING)
MCC2 (EXISTING)
MCC4 (EXISTING)
56-SWP-01
L3
EXISTING HANDHOLE
C17
C17
59 - MAINTENANCE BUILDING
1 C18
EXISTING HANDHOLE
10 - SUPERVISOR'S OFFICE BUILDING
SUPERVISOR'S OFFICE BUILDING TRANSFORMER (EXISTING)
PANEL P4 (EXISTING)
HANDHOLE 2'X2'
10-SWP-01
C42
C43
C38
CP-05-SWP-01
EXISTING HANDHOLE
C39
EXISTING MANHOLE
C15
56 - SLUDGE PUMP AND GAS GENERATOR BUILDING
EXISTING HANDHOLE
C16
HANDHOLE 2'X2'
HIGH MAST LIGHT TOWER
EXISTING HANDHOLE
C43
50 - CHLORINE BUILDING
HANDHOLE 2'X2' - INTERCEPT EXISTING DUCT
C44
C45
L8
HANDHOLE 2'X2'
50 SWP-01
C46
MCP-520
MCP-510
C06
EXISTING MANHOLE
P13
52-CP-1
L1
MAIN SWGR (EXISTING)
MCC1 (EXISTING)
P11
MANHOLE 5'X5'
52 - GENERATOR ELECTRICAL BUILDING
52-SWP-01
C14
HIGH MAST LGT. TOWER #1
EXISTING HANDHOLE
1 C02
HANDHOLE 2'X2' - INTERCEPT EXISTING DUCT
C04
C05
P10
C07
HANDHOLE 2'X2' - INTERCEPT EXISTING DUCT
C09
P08
P09
EXISTING HANDHOLE
MANHOLE 5'X5' - INTERCEPT EXISTING DUCT
54 - OPERATIONS BUILDING
MCC5 (EXISTING)
MCP-520
C40
C03
P04
P05
P12
P06
EXISTING MANHOLE
L4
P3
54-CP-01
P1
UPS
P2
54-SWP-01
MANHOLE 5'X5' - INTERCEPT EXISTING DUCT
P07
L2
C08 1
EXISTING HANDHOLE
C13 1
MCP-200
C12 1
LCP01-SWP-01
C11 3
MCP-250
20-SWP-01
2 C10
20 - INFLUENT PUMP STATION
P03
58-CP-1
58-SMI-OTRACK-01
58-SMI-OTRACK-02
P02
58 - OPERATIONS ELECTRICAL BUILDING (PROPOSED)
NEW UTILITY TRANSFORMER
C01
P01
ELECTRIC UTILITY POLE (TYP)
EXISTING HANDHOLE
61-SWP-01
C47
PANEL P (EXISTING)
PANEL L (EXISTING)
61 - NORTHWEST MAINTENANCE BUILDING

GENERAL SHEET NOTES

1. SEE SPECIFICATION 01 11 00 FOR ALTERNATE BID ITEMS APPLICABLE TO CONDUCTOR REPLACEMENTS OUTSIDE BUILDINGS.
2. CONDUIT ROUTING REPRESENTS UTILIZATION OF EXISTINGUNDERGROUND UTILITES. WHEREVER PRACTIAL, USE

SHEET KEYNOTES

1. ROUTE ALONG EXISTING DUCT.
2. ROUTE ALONG EXISTING DUCT TO WALL FACE AND THEN SURFACE MOUNT TO LCP-SWP-01 AND TO MCP-250.
3. SURFACE MOUNT CONDUIT FROM LCP-SWP-01 TO MCP-250.

NO.	DATE	REVISION	BY	APVD
DSGN	R FURMANSKI	DR R FURMANSKI	CHK D NICHOLSON	APVD T TWIST

WRIGHT SMITH, JR.
WASTEWATER TREATMENT PLANT
ELECTRICAL, I&C AND HVAC MODIFICATIONS
MOBILE AREA WATER AND SEWER SYSTEMS
MOBILE, ALABAMA

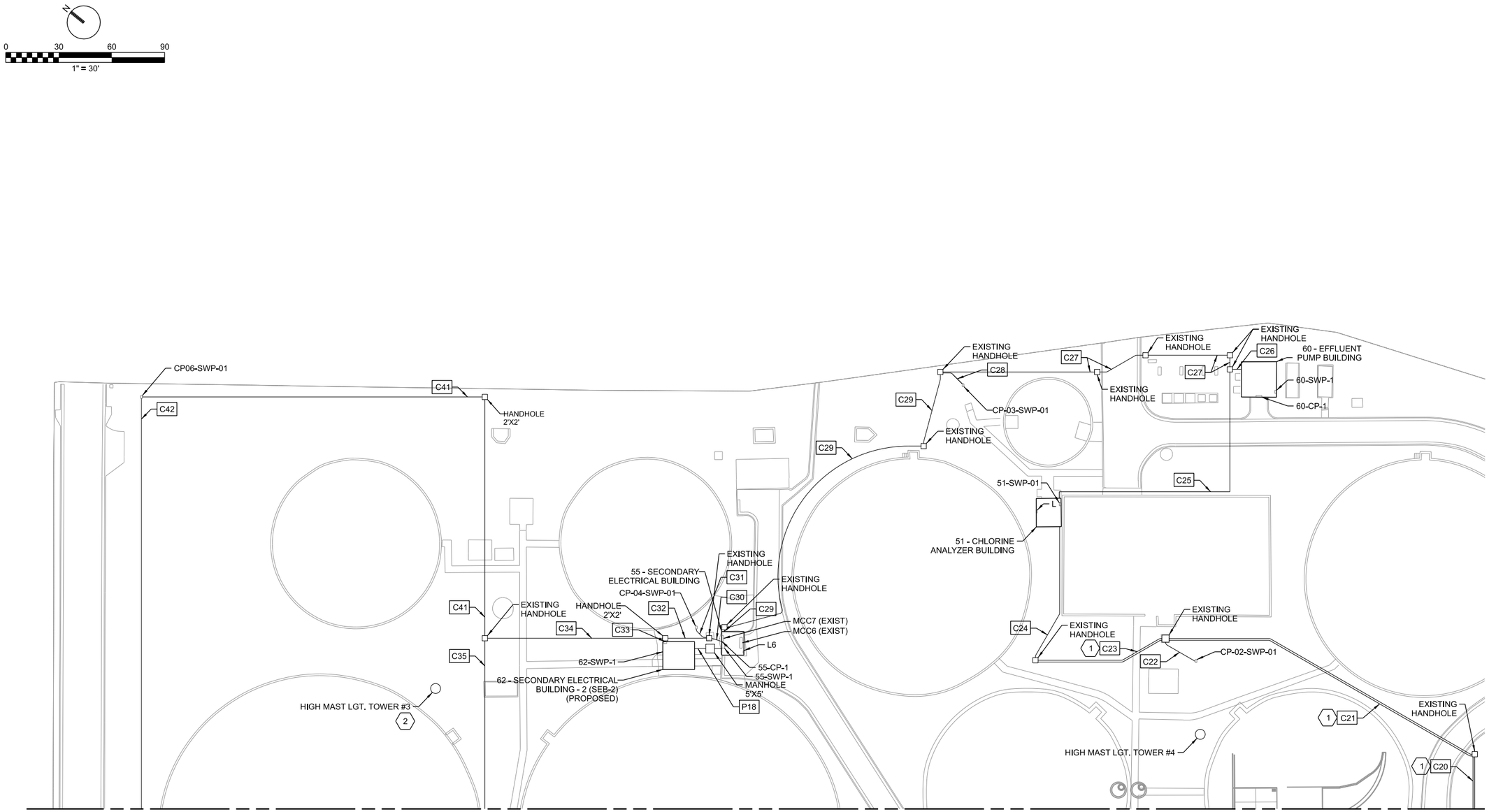
Jacobs

ELECTRICAL
SITE PLAN OVERALL

NTS
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2026
PROJ	D3755100
DWG	05-E-2001
SHEET	021 of 138

BID DOCUMENTS



MATCHLINE SEE 05-E-2001

GENERAL SHEET NOTES

1. SEE SPECIFICATION 01 11 00 FOR ALTERNATE BID ITEMS APPLICABLE TO CONDUCTOR REPLACEMENTS OUTSIDE BUILDINGS.

SHEET KEYNOTES

1. ROUTE ALONG EXISTING DUCT.
2. REPLACE EXISTING HIGH MAST LIGHTS WITH LED EQUIVALENT. EXISTING HIGH MAST LIFTING SYSTEM IS INOPERABLE; REPLACE WITH IN KIND PORTER CABLE MODEL 77750 OR CURRENT EQUIVALENT.

NO.	DATE	REVISION	DR	CHK	BY
DSGN	R FURMANSKI		R FURMANSKI	D NICHOLSON	APVD
					T TWIST

WRIGHT SMITH, JR.
WASTEWATER TREATMENT PLANT
ELECTRICAL, I&C AND HVAC MODIFICATIONS
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ELECTRICAL
SITE PLAN OVERALL

NTS
VERIFY SCALE
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0 1"

DATE	JANUARY 2026
PROJ	D3755100
DWG	05-E-2002
SHEET	022 of 138

BID DOCUMENTS

C01 SECTION
NTS

1 = [2"C, [FMM] FROM 54-SWP-01 TO 61-SWP-01] (EXISTING CONDUIT)

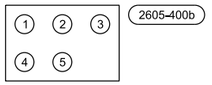
2 = [2"C, [SPARE] FROM 58-SMI-OTRACK-02
TO UNITI FIBER CONNECTION] (EXISTING CONDUIT)

C02 SECTION
NTS

1 = [2"C, [FMM] FROM 54SWP-01 TO 58-SMI-OTRACK-02] (EXISTING CONDUIT)
[FMM] FROM 54-SMI-COMRACK-01 TO 58-SMI-OTRACK-02]

2 = [2"C, [FMM] FROM 54-CP-1 TO 58-SMI-OTRACK-01] (EXISTING CONDUIT)

3 = [2"C, [SPARE] FROM 58-SMI-OTRACK-02 TO UNITI FIBER CONNECTION]



C03 SECTION
NTS

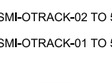
1 = [2"C, [FMM] FROM 54SWP-01 TO 58-SMI-OTRACK-02]
[FMM] FROM 54-SMI-COMRACK-01 TO 58-SMI-OTRACK-02]

2 = [2"C, [FMM] FROM 54-CP-1 TO 58-SMI-OTRACK-01]

3 = [2"C, [SPARE] FROM 58-SMI-OTRACK-02 TO UNITI FIBER CONNECTION]

4 = [2"C, [FMM] FROM 58-SMI-OTRACK-02 TO 52-TJB-1]

5 = [2"C, [FMM] FROM 58-SMI-OTRACK-01 TO 52-CP-1]



C04 SECTION
NTS

1 = [2"C, [FMM] FROM 58-SMI-OTRACK-02 TO 52-TJB-1] (EXISTING CONDUIT)
[FMM] FROM 58-SMI-OTRACK-01 TO 52-CP-1]

C05 SECTION
NTS

1 = [2"C, [FMM] FROM 58-SMI-OTRACK-02 TO 52-TJB-1] (EXISTING CONDUIT)
[FMM] FROM 58-SMI-OTRACK-01 TO 52-CP-1]

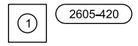
C06 SECTION
NTS

1 = [1"C, [FMM] FROM MCP-510 TO 52-CP-1] (EXISTING CONDUIT)

2 = [1"C, [FMM] FROM MCP-520 TO 52-CP-1] (EXISTING CONDUIT)

C07 SECTION
NTS

1 = [1"C, [FMM] FROM 52-TJB-1 TO 20-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 52-CP-1 TO MCP-250]

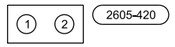


C08 SECTION
NTS

1 = [2"C, [FMM] FROM 52-TJB-1 TO 20-SWP-01]
[FMM] FROM 20-SWP-01 TO LCP01-SWP-01]

C09 SECTION
NTS

1 = [1"C, [FMM] FROM 20-SWP-01 TO LCP01-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 52-CP-1 TO MCP-250]



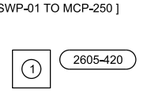
C10 SECTION
NTS

1 = [2"C, [FMM] FROM 20-SWP-01 TO LCP01-SWP-01]

2 = [2"C, [FMM] FROM 52-CP-1 TO MCP-250]

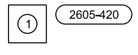
C11 SECTION
NTS

1 = [2"C, [FMM] FROM LCP01-SWP-01 TO MCP-250]



C12 SECTION
NTS

1 = [2"C, [FMM] FROM MCP-250 TO MCP-200]
[FMM] FROM MCP-250 TO MCP-200]



C13 SECTION
NTS

1 = [2"C, [FMM] FROM MCP-200 TO 56-SWP-01]
[FMM] FROM MCP-200 TO EXISTING SCADA NETWORK PANEL (56)]

C14 SECTION
NTS

1 = [1"C, [FMM] FROM MCP-200 TO 56-SWP-01] (EXISTING CONDUIT)
[FMM] FROM MCP-200 TO EXISTING SCADA NETWORK PANEL (56)]

C15 SECTION
NTS

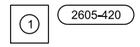
1 = [2"C, [FMM] FROM 56-SWP-01 TO 59-SWP-01]
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO CP-60-1]

C16 SECTION
NTS

1 = [1 1/2"C, [FMM] FROM 56-SWP-01 TO 59-SWP-01] (EXISTING CONDUIT)
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO CP-60-1]

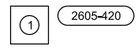
C17 SECTION
NTS

1 = [1"C, [FMM] FROM 56-SWP-01 TO 59-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 59-SWP-01 TO CP01-SWP-01]



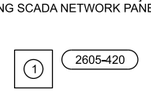
C18 SECTION
NTS

1 = [2"C, [FMM] FROM 59-SWP-01 TO CP01-SWP-01]
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO CP-60-1]



C19 SECTION
NTS

1 = [2"C, [FMM] FROM CP01-SWP-01 TO CP02-SWP-01]
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO CP-60-1]

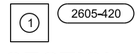


C20 SECTION
NTS

1 = [2"C, [FMM] FROM CP01-SWP-01 TO CP02-SWP-01]
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO CP-60-1]

C21 SECTION
NTS

1 = [2"C, [FMM] FROM CP01-SWP-01 TO CP02-SWP-01]
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO CP-60-1]



C22 SECTION
NTS

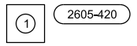
1 = [2"C, [FMM] FROM CP01-SWP-01 TO CP02-SWP-01]
[FMM] FROM CP02-SWP-01 TO 51-SWP-01]

C23 SECTION
NTS

1 = [2"C, [FMM] FROM CP02-SWP-01 TO 51-SWP-01]
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO 60-CP-1]

C24 SECTION
NTS

1 = [2"C, [FMM] FROM CP02-SWP-01 TO 51-SWP-01]
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO 60-CP-1]



C25 SECTION
NTS

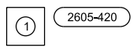
1 = [2"C, [FMM] FROM 51-SWP-01 TO 60-CP-1]
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO 60-CP-1]

C26 SECTION
NTS

1 = [2"C, [FMM] FROM 51-SWP-01 TO 60-CP-1] (EXISTING CONDUIT)
[FMM] FROM EXISTING SCADA NETWORK PANEL (56) TO 60-CP-1]
[FMM] FROM 60-CP-1 TO CP03-SWP-01]
[FMM] FROM 60-CP-1 TO 55-CP-1]

C27 SECTION
NTS

1 = [2"C, [FMM] FROM 60-CP-1 TO CP03-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 60-CP-1 TO 55-CP-1]



C28 SECTION
NTS

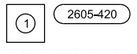
1 = [2"C, [FMM] FROM 60-CP-1 TO CP03-SWP-01]
[FMM] FROM CP03-SWP-01 TO CP04-SWP-01]

C29 SECTION
NTS

1 = [2"C, [FMM] FROM CP03-SWP-01 TO CP04-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 60-CP-1 TO 55-CP-1]

C30 SECTION
NTS

1 = [2"C, [FMM] FROM CP03-SWP-01 TO CP04-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 55-CP-1 TO 54-CP-1]



C31 SECTION
NTS

1 = [2"C, [FMM] FROM CP03-SWP-01 TO CP04-SWP-01]
[FMM] FROM CP04-SWP-01 TO 62-SWP-01]

C32 SECTION
NTS

1 = [1"C, [FMM] FROM CP04-SWP-01 TO 62-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 55-CP-1 TO 54-CP-1]

SHEET KEYNOTES

1. ROUTE CONDUIT FROM LCP01-SWP-01 TO MCP-250 EXPOSED. FIELD VERIFY AND CONFIRM ROUTING WITH ENGINEER.

NO.	DATE	DSGN
DR	R FURMANSKI	R FURMANSKI
CHK	D NICHOLSON	APVD
REVISION		
BY	T TWIST	APVD

WRIGHT SMITH, JR.
WASTEWATER TREATMENT PLANT
ELECTRICAL, I&C AND HVAC MODIFICATIONS
MOBILE AREA WATER AND SEWER SYSTEMS
MOBILE, ALABAMA

Jacobs

ELECTRICAL
DUCTBANK SECTIONS

NTS
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2026
PROJ	D3755100
DWG	05-E-6001
SHEET	023 of 138

BID DOCUMENTS

1 2 3 4 5 6

A

B

C

D

1 2605-420

C33 SECTION NTS

1 = [2"C, [FMM] FROM CP04-SWP-01 TO 62-SWP-01]
[FMM] FROM 62-SWP-01 TO 57-SWP-01]
[FMM] FROM 62-SWP-01 TO CP06-SWP-01]

1

C34 SECTION NTS

1 = [1"C, [FMM] FROM 62-SWP-01 TO 57-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 62-SWP-01 TO CP06-SWP-01]
[FMM] FROM 55-CP-1 TO 54-CP-1]

1

C35 SECTION NTS

1 = [1 1/2"C, [FMM] FROM 62-SWP-01 TO 57-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 55-CP-1 TO 54-CP-1]

1

C36 SECTION NTS

1 = [1"C, [FMM] FROM 62-SWP-01 TO 57-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 57-SWP-01 TO CP05-SWP-01]

1

C37 SECTION NTS

1 = [1"C, [FMM] FROM 57-SWP-01 TO CP05-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 55-CP-1 TO 54-CP-1]

1 2605-420

C38 SECTION NTS

1 = [2"C, [FMM] FROM 57-SWP-01 TO CP05-SWP-01] (EXISTING CONDUIT)
[FMM] FROM CP05-SWP-01 TO 54-SWP-01]

1

C39 SECTION NTS

1 = [1"C, [FMM] FROM CP05-SWP-01 TO 54-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 55-CP-1 TO 54-CP-1]

1

C40 SECTION NTS

1 = [3"C, [FMM] FROM CP05-SWP-01 TO 54-SWP-01] (EXISTING CONDUIT)
[FMM] FROM 54SWP-01 TO 58-SMI-OTRACK-02]
[FMM] FROM 54-SWP-01 TO 61-SWP-01]
[FMM] FROM 55-CP-1 TO 54-CP-1]
[FMM] FROM 54-SMI-COMRACK-01 TO 58-SMI-OTRACK-02]

1 2605-420

C41 SECTION NTS

1 = [2"C, [FMM] FROM 62-SWP-01 TO CP06-SWP-01]

1 2605-420

C42 SECTION NTS

1 = [2"C, [FMM] FROM CP06-SWP-01 TO 10-SWP-01]

1 2605-420

C43 SECTION NTS

1 = [1"C, [FMM] FROM 10-SWP-01 TO 50-SWP-01] (EXISTING CONDUIT)

1 2605-420

C44 SECTION NTS

1 = [2"C, [FMM] FROM 10-SWP-01 TO 50-SWP-01]

1 2605-420

C45 SECTION NTS

1 = [2"C, [FMM] FROM 10-SWP-01 TO 50-SWP-01]
[FMM] FROM 50-SWP-01 TO 61-SWP-01]

1 2605-420

C46 SECTION NTS

1 = [2"C, [FMM] FROM 50-SWP-01 TO 61-SWP-01]

1

C47 SECTION NTS

1 = [2"C, [FMM] FROM 61-SWP-01 TO 54-SWP-01] (EXISTING CONDUIT)

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN	R FURMANSKI		R FURMANSKI	D NICHOLSON		T TWIST	

WRIGHT SMITH, JR.
WASTEWATER TREATMENT PLANT
ELECTRICAL, I&C AND HVAC MODIFICATIONS
MOBILE AREA WATER AND SEWER SYSTEMS
MOBILE, ALABAMA

Jacobs

ELECTRICAL
DUCTBANK SECTIONS

NTS
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2026
PROJ	D3755100
DWG	05-E-6002
SHEET	024 of 138

BID DOCUMENTS

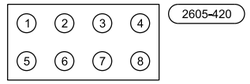
P01 SECTION
NTS

2 FOR USE BY ALABAMA POWER:

1 = [4"C, [SPARE] FROM UTILITY POLE TO UTILITY XFMR]

2 = [4"C, [SPARE] FROM UTILITY POLE TO UTILITY XFMR]

3 = [4"C, [SPARE] FROM UTILITY POLE TO UTILITY XFMR]



P02 SECTION
NTS

1 = [3 1/2"C, [3200E3] FROM MAIN SWITCHBOARD TO UTILITY XFMR (1 OF 8)]

2 = [3 1/2"C, [3200E3] FROM MAIN SWITCHBOARD TO UTILITY XFMR (2 OF 8)]

3 = [3 1/2"C, [3200E3] FROM MAIN SWITCHBOARD TO UTILITY XFMR (3 OF 8)]

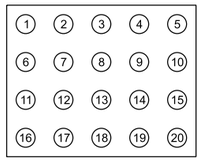
4 = [3 1/2"C, [3200E3] FROM MAIN SWITCHBOARD TO UTILITY XFMR (4 OF 8)]

5 = [3 1/2"C, [3200E3] FROM MAIN SWITCHBOARD TO UTILITY XFMR (5 OF 8)]

6 = [3 1/2"C, [3200E3] FROM MAIN SWITCHBOARD TO UTILITY XFMR (6 OF 8)]

7 = [3 1/2"C, [3200E3] FROM MAIN SWITCHBOARD TO UTILITY XFMR (7 OF 8)]

8 = [3 1/2"C, [3200E3] FROM MAIN SWITCHBOARD TO UTILITY XFMR (8 OF 8)]



P03 SECTION
NTS

1 = [1"C, [30E3] FROM PANEL L8 (50) TO MCC1 VIA CABINET (54)]

2 = [1"C, [20E3] FROM CL2/S02 SCRUBBER TO MCC1 VIA CABINET (54)]

3 = [1"C, [20E3] FROM PRIMARY SLUDGE AND SCUM PUMP NO. 1 TO MCC1 VIA CABINET (54)]

4 = [1"C, [20E3] FROM PRIMARY SLUDGE AND SCUM PUMP NO. 3 TO MCC1 VIA CABINET (54)]

5 = [1"C, [20E3] FROM PRIMARY CLARIFIER NO. 1 TO MCC1 VIA CABINET (54)]

6 = [1"C, [20E3] FROM PRIMARY CLARIFIER NO. 3 TO MCC1 VIA CABINET (54)]

7 = [1"C, [20E3] FROM AIR CONDITIONER TO MCC1 VIA CABINET (54)]

8 = [1"C, [20E3] FROM LIGHTING TOWER NO. 2 TO MCC2 VIA CABINET (54)]

9 = [1"C, [30E3] FROM PANEL L4 (54) TO MCC2 VIA CABINET (54)]

10 = [1"C, [20E3] FROM PRIMARY SLUDGE AND SCUM PUMP NO. 2 TO MCC2 VIA CABINET (54)]

11 = [1"C, [20E3] FROM PRIMARY SLUDGE AND SCUM PUMP NO. 4 TO MCC2 VIA CABINET (54)]

12 = [1"C, [20E3] FROM PRIMARY CLARIFIER NO. 2 TO MCC2 VIA CABINET (54)]

13 = [1"C, [20E3] FROM PRIMARY CLARIFIER NO. 4 TO MCC2 VIA CABINET (54)]

1 14 = [2"C, [C10] FROM PRIMARY SLUDGE AND SCUM PUMP NO. 1 TO MCC1 VIA CABINET (54)]
[C10] FROM PRIMARY SLUDGE AND SCUM PUMP NO. 3 TO MCC1 VIA CABINET (54)]
[C10] FROM PRIMARY CLARIFIER NO. 1 TO MCC1 VIA CABINET (54)]
[C10] FROM PRIMARY CLARIFIER NO. 3 TO MCC1 VIA CABINET (54)]
[C6] FROM AIR CONDITIONER TO MCC1 VIA CABINET (54)]
[C10] FROM PRIMARY SLUDGE AND SCUM PUMP NO. 2 TO MCC1 VIA CABINET (54)]
[C10] FROM PRIMARY SLUDGE AND SCUM PUMP NO. 4 TO MCC1 VIA CABINET (54)]
[C10] FROM PRIMARY CLARIFIER NO. 2 TO MCC1 VIA CABINET (54)]
[C10] FROM PRIMARY CLARIFIER NO. 4 TO MCC1 VIA CABINET (54)]

15 = 2"C, [SPARE]]

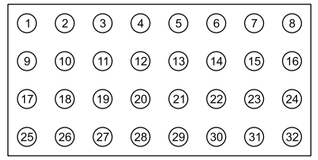
16 = 2"C, [SPARE]]

P04 SECTION
NTS

1 = [3"C, [150E3] FROM PANEL P4 (54) TO MCC2 VIA CABINET (54)] (EXISTING CONDUIT)
(REUSE EXISTING CONDUIT FOR MCC5 FEED)

2 = 3"C, [50E3] FROM UPS PANEL (54) TO MCC1 VIA CABINET (54)] (EXISTING CONDUIT)
(USE EXISTING SPARE CONDUIT)

3 = [2 1/2"C, [150E3] FROM PANEL P1 (54) TO MCC1 VIA CABINET (54)] (EXISTING CONDUIT)
(REUSE EXISTING CONDUIT FOR PANEL P1 FEEDER)



P05 SECTION
NTS

1 = [3"C, [600E3] FROM MCC3 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

2 = [3"C, [600E3] FROM MCC3 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

3 = [3"C, [600E3] FROM MCC4 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

4 = [3"C, [600E3] FROM MCC4 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

5 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

6 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

7 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

8 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

9 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (1 OF 5)]

10 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (2 OF 5)]

11 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (3 OF 5)]

12 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (4 OF 5)]

13 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (5 OF 5)]

14 = [1"C, [30E3] FROM PANEL P (61) TO MCC1 VIA CABINET (52)]

15 = [1"C, [30E3] FROM PANEL L1 (61) TO MCC1]

16 = [1"C, [30E3] FROM POST THICKENER RAKE TO MCC1 VIA CABINET (52)]

17 = [1"C, [30E3] FROM PANEL L2 (20) TO MCC2 VIA CABINET (52)]

18 = [1 1/2"C, [150E3] FROM PANEL P4 (10) TO MCC1 VIA CABINET (52)]

19 = [1 1/2"C, [100E3] FROM PANEL L52 (52) TO PANEL L58]

1 20 = [1"C, [C10] FROM POST THICKENER RAKE TO MCC1 VIA CABINET (52)]

21 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (1 OF 3)]

22 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (2 OF 3)]

23 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (3 OF 3)]

24 = [2"C, [SPARE]]

25 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 1 TO INF. PUMP VFD NO. 1]

26 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 2 TO INF. PUMP VFD NO. 2]

27 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 3 TO INF. PUMP VFD NO. 3]

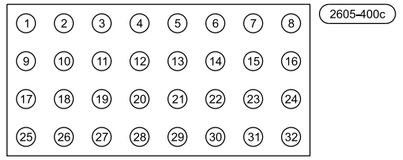
28 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 4 TO INF. PUMP VFD NO. 4]

29 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 5 TO INF. PUMP VFD NO. 5]

1 30 = [1"C, [C6] FROM FROM INFLUENT PUMP NO. 1 TO INF. PUMP VFD NO. 1]
[C6] FROM FROM INFLUENT PUMP NO. 2 TO INF. PUMP VFD NO. 2]
[C6] FROM FROM INFLUENT PUMP NO. 3 TO INF. PUMP VFD NO. 3]
[C6] FROM FROM INFLUENT PUMP NO. 4 TO INF. PUMP VFD NO. 4]
[C6] FROM FROM INFLUENT PUMP NO. 5 TO INF. PUMP VFD NO. 5]

31 = [1 1/2"C, [125E3] FROM MCC8 TO MAIN SWBD]

32 = [2"C, [SPARE]]



P06 SECTION
NTS

1 = [3"C, [600E3] FROM MCC3 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

2 = [3"C, [600E3] FROM MCC3 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

3 = [3"C, [600E3] FROM MCC4 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

4 = [3"C, [600E3] FROM MCC4 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

5 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

6 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

7 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

8 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

9 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (1 OF 5)]

10 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (2 OF 5)]

11 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (3 OF 5)]

12 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (4 OF 5)]

13 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (5 OF 5)]

14 = [1"C, [30E3] FROM PANEL P (61) TO MCC1 VIA CABINET (52)]

15 = [1"C, [30E3] FROM PANEL L1 (61) TO MCC1]

16 = [1"C, [30E3] FROM POST THICKENER RAKE TO MCC1 VIA CABINET (52)]

17 = [1"C, [30E3] FROM PANEL L2 (20) TO MCC2 VIA CABINET (52)]

18 = [1 1/2"C, [150E3] FROM PANEL P4 (10) TO MCC1 VIA CABINET (52)]

19 = [1 1/2"C, [100E3] FROM PANEL L52 (52) TO PANEL L58]

1 20 = [1"C, [C10] FROM POST THICKENER RAKE TO MCC1 VIA CABINET (52)]

21 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (1 OF 3)]

22 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (2 OF 3)]

23 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (3 OF 3)]

24 = [2"C, [SPARE]]

25 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 1 TO INF. PUMP VFD NO. 1]

26 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 2 TO INF. PUMP VFD NO. 2]

27 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 3 TO INF. PUMP VFD NO. 3]

28 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 4 TO INF. PUMP VFD NO. 4]

29 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 5 TO INF. PUMP VFD NO. 5]

1 30 = [1"C, [C6] FROM FROM INFLUENT PUMP NO. 1 TO INF. PUMP VFD NO. 1]
[C6] FROM FROM INFLUENT PUMP NO. 2 TO INF. PUMP VFD NO. 2]
[C6] FROM FROM INFLUENT PUMP NO. 3 TO INF. PUMP VFD NO. 3]
[C6] FROM FROM INFLUENT PUMP NO. 4 TO INF. PUMP VFD NO. 4]
[C6] FROM FROM INFLUENT PUMP NO. 5 TO INF. PUMP VFD NO. 5]

31 = [2"C, [SPARE]]

32 = [2"C, [SPARE]]

P07 SECTION
NTS

1 = [2"C, [175PV3] FROM INFLUENT PUMP NO. 1 TO INF. PUMP VFD NO. 1] (EXISTING CONDUIT)

2 = [2"C, [175PV3] FROM INFLUENT PUMP NO. 2 TO INF. PUMP VFD NO. 2] (EXISTING CONDUIT)

3 = [2"C, [175PV3] FROM INFLUENT PUMP NO. 3 TO INF. PUMP VFD NO. 3] (EXISTING CONDUIT)

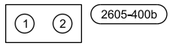
4 = [2"C, [175PV3] FROM INFLUENT PUMP NO. 4 TO INF. PUMP VFD NO. 4] (EXISTING CONDUIT)

5 = [1"C, [C6] FROM FROM INFLUENT PUMP NO. 1 TO INF. PUMP VFD NO. 1] (EXISTING CONDUIT)

6 = [1"C, [C6] FROM FROM INFLUENT PUMP NO. 2 TO INF. PUMP VFD NO. 2] (EXISTING CONDUIT)

7 = [1"C, [C6] FROM FROM INFLUENT PUMP NO. 3 TO INF. PUMP VFD NO. 3] (EXISTING CONDUIT)

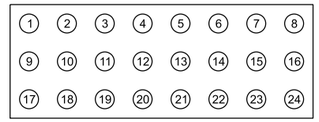
8 = [1"C, [C6] FROM FROM INFLUENT PUMP NO. 4 TO INF. PUMP VFD NO. 4] (EXISTING CONDUIT)



P08 SECTION
NTS

1 = [2 1/2"C, [175PV3] FROM INFLUENT PUMP NO. 5 TO INF. PUMP VFD NO. 5]

2 = [1"C, [C6] FROM FROM INFLUENT PUMP NO. 5 TO INF. PUMP VFD NO. 5]



P09 SECTION
NTS

1 = [3"C, [600E3] FROM MCC3 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

2 = [3"C, [600E3] FROM MCC3 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

3 = [3"C, [600E3] FROM MCC4 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

4 = [3"C, [600E3] FROM MCC4 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

5 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

6 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

7 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]

8 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]

9 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (1 OF 5)]

10 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (2 OF 5)]

11 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (3 OF 5)]

12 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (4 OF 5)]

13 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (5 OF 5)]

14 = [1"C, [30E3] FROM PANEL P (61) TO MCC1 VIA CABINET (52)]

15 = [1"C, [30E3] FROM PANEL L1 (61) TO MCC1]

16 = [1"C, [30E3] FROM POST THICKENER RAKE TO MCC1 VIA CABINET (52)]

17 = [1"C, [30E3] FROM PANEL L2 (20) TO MCC2 VIA CABINET (52)]

18 = [1 1/2"C, [150E3] FROM PANEL P4 (10) TO MCC1 VIA CABINET (52)]

19 = [1 1/2"C, [100E3] FROM PANEL L52 (52) TO PANEL L58]

1 20 = [1"C, [C10] FROM POST THICKENER RAKE TO MCC1 VIA CABINET (52)]

21 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (1 OF 3)]

22 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (2 OF 3)]

23 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (3 OF 3)]

24 = [2"C, [SPARE]]

P10 SECTION
NTS

1 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (1 OF 3)]

2 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (2 OF 3)]

3 = [3"C, [1000E3] FROM EXST BOILER MAIN DISCONNECT (52) TO MAIN SWBD (3 OF 3)]

SHEET KEYNOTES

1. REFER TO DRAWINGS 06-E-6201 AND 06-E-6202. VERIFY CONFIGURATION OF EXISTING MOTOR STARTERS AND REQUIRED SIGNALS FOR NEW STARTERS. MODIFY THE QUANTITY OF SIGNAL CONDUCTORS AS NEEDED TO ACCOMODATE THE REQUIRED I/O.
2. COORDINATE SIZE AND QUANTITY OF CONDUITS REQUIRED FOR CONNECTION TO UTILITY TRANSFORMER WITH ALABAMA POWER.

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		R FURMANSKI	R FURMANSKI	D NICHOLSON	APVD	T TWIST	

WRIGHT SMITH, JR.
WASTEWATER TREATMENT PLANT
ELECTRICAL, I&C AND HVAC MODIFICATIONS
MOBILE AREA WATER AND SEWER SYSTEMS
MOBILE, ALABAMA

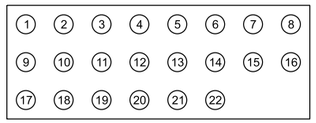
Jacobs

ELECTRICAL
DUCTBANK SECTIONS

NTS
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2026
PROJ	D3755100
DWG	05-E-6001
SHEET	023 of 138

BID DOCUMENTS



2605-400c

P11 SECTION
NTS

1 = [3"C, [600E3] FROM MCC3 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]
2 = [3"C, [600E3] FROM MCC3 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]
3 = [3"C, [600E3] FROM MCC4 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]
4 = [3"C, [600E3] FROM MCC4 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]
5 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]
6 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]
7 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (52) (1 OF 2)]
8 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (52) (2 OF 2)]
9 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (1 OF 5)]
10 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (2 OF 5)]
11 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (3 OF 5)]
12 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (4 OF 5)]
13 = [4"C, [2000E4] FROM EXISTING GENERATOR TO MAIN SWBD (5 OF 5)]
14 = [1"C, [30E3] FROM PANEL P (61) TO MCC1 VIA CABINET (52)]
15 = [1"C, [30E3] FROM PANEL L1 (61) TO MCC1]
16 = [1"C, [30E3] FROM POST THICKENER RAKE TO MCC1 VIA CABINET (52)]
17 = [1"C, [30E3] FROM PANEL L2 (20) TO MCC2 VIA CABINET (52)]
18 = [1 1/2"C, [150E3] FROM PANEL P4 (10) TO MCC1 VIA CABINET (52)]
19 = [1 1/2"C, [100E3] FROM PANEL L52 (52) TO PANEL L58]
(1) 20 = [1"C, [C10] FROM POST THICKENER RAKE TO MCC1 VIA CABINET (52)]
21 = [2"C, [SPARE]]
22 = [2"C, [SPARE]]

P12 SECTION
NTS

1 = [3"C, [125E3] FROM MCC8 TO MAIN SWBD] (EXISTING CONDUIT)
(REUSE EXISTING CONDUIT FOR MCC5 FEEDER)

P13 SECTION
NTS

1 = [3"C, [125E3] FROM MCC8 TO MAIN SWBD] (EXISTING CONDUIT)

P14 SECTION
NTS

1 = [3"C, [125E3] FROM MCC8 TO MAIN SWBD] (EXISTING CONDUIT)

P15 SECTION
NTS

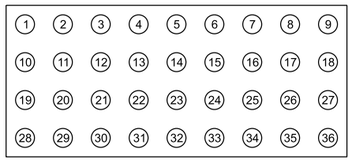
1 = [3"C, [125E3] FROM MCC8 TO MAIN SWBD] (EXISTING CONDUIT)

P16 SECTION
NTS

1 = [3"C, [125E3] FROM MCC8 TO MAIN SWBD] (EXISTING CONDUIT)

P17 SECTION
NTS

1 = [3"C, [125E3] FROM MCC8 TO MAIN SWBD] (EXISTING CONDUIT)



2605-400c

P18 SECTION
NTS

1 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (55) (1 OF 2)]
2 = [3"C, [600E3] FROM MCC6 TO MAIN SWBD VIA CABINET (55) (2 OF 2)]
3 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (55) (1 OF 2)]
4 = [3"C, [600E3] FROM MCC7 TO MAIN SWBD VIA CABINET (55) (2 OF 2)]
5 = [1"C, [30E3] FROM PANEL L6 (55) TO MCC6 VIA CABINET (55)]
6 = [1"C, [20E3] FROM AIR CONDITIONER TO MCC6 VIA CABINET (55)]
7 = [1"C, [20E3] FROM FCV-11 TO MCC6 VIA CABINET (55)]
8 = [1"C, [20E3] FROM LIGHTING TOWER NO. 3 TO MCC6 VIA CABINET (55)]
9 = [1"C, [30E3] FROM NITRIFICATION RECIRC PUMP NO. 3 TO MCC6 VIA CABINET (55)]
10 = [1"C, [30E3] FROM NITRIFICATION RECIRC PUMP NO. 1 TO MCC6 VIA CABINET (55)]
11 = [1"C, [20E3] FROM INTERMEDIATE CLARIFIER TO MCC6 VIA CABINET (55)]
12 = [1"C, [20E3] FROM FINAL CLARIFIER NO. 1 TO MCC6 VIA CABINET (55)]
13 = [2 1/2"C, [100PV3] FROM SECONDARY EFF. PUMP NO. 3 TO MCC7 VIA CABINET (55)]
14 = [2 1/2"C, [150PV3] FROM SECONDARY EFF. PUMP NO. 1 TO MCC7 VIA CABINET (55)]
15 = [1"C, [20E3] FROM FCV-36 TO MCC6 VIA CABINET (55)]
16 = [1"C, [20E3] FROM TRICKLING FILTER TO MCC6 VIA CABINET (55)]
17 = [2 1/2"C, [100PV3] FROM RECYCLE PUMP NO. 1 TO MCC6 VIA CABINET (55)]
18 = [2 1/2"C, [100PV3] FROM RECYCLE PUMP NO. 3 TO MCC6 VIA CABINET (55)]
19 = [1 1/2"C, [150E3] FROM POST AER/REUSE WTR PUMPS TO MCC7 VIA CABINET (55)]
20 = [1"C, [20E3] FROM LIGHTING LOWER NO. 4 TO MCC7 VIA CABINET (55)]
21 = [1"C, [30E3] FROM NITRIFICATION RECIRC PUMP NO. 4 TO MCC7 VIA CABINET (55)]
22 = [1"C, [30E3] FROM NITRIFICATION RECIRC PUMP NO. 2 TO MCC7 VIA CABINET (55)]
23 = [1"C, [20E3] FROM INTERMEDIATE CLARIFIER NO. 4 TO MCC7 VIA CABINET (55)]
24 = [1"C, [20E3] FROM FINAL CLARIFIER NO. 2 TO MCC7 VIA CABINET (55)]
25 = [2 1/2"C, [100PV3] FROM SECONDARY EFF. PUMP NO. 4 TO MCC7 VIA CABINET (55)]
26 = [2 1/2"C, [150PV3] FROM SECONDARY EFF. PUMP NO. 2 TO MCC7 VIA CABINET (55)]
27 = [1"C, [20E3] FROM FCV-41 TO MCC7 VIA CABINET (55)]
28 = [1"C, [20E3] FROM TRICKLING FILTER NO. 2 TO MCC7 VIA CABINET (55)]
29 = [2 1/2"C, [100PV3] FROM RECYCLE PUMP NO. 2 TO MCC6 VIA CABINET (55)]
30 = [1"C, [20E2] FROM 55-CP-1 TO L62 (62)]
31 = [1"C, [20E2] FROM 55-SMI-OWS-01TO L62 (62)]
(1) 32 = [2"C, [C10] FROM NITRIFICATION RECIRC PUMP NO. 3 TO MCC6 VIA CABINET (55)
[C10] FROM NITRIFICATION RECIRC PUMP NO. 1 TO MCC6 VIA CABINET (55)
[C10] FROM FROM SECONDARY EFF. PUMP NO. 3 TO MCC6 VIA CABINET (55)
[C10] FROM FROM SECONDARY EFF. PUMP NO. 1 TO MCC6 VIA CABINET (55)
[C10] FROM RECYCLE PUMP NO. 3 TO MCC6 VIA CABINET (55)
[C10] FROM RECYCLE PUMP NO. 1 TO MCC6 VIA CABINET (55)
[C10] FROM NITRIFICATION RECIRC PUMP NO. 4 TO MCC6 VIA CABINET (55)
[C10] FROM NITRIFICATION RECIRC PUMP NO. 2 TO MCC6 VIA CABINET (55)
[C10] FROM FROM SECONDARY EFF. PUMP NO. 4 TO MCC6 VIA CABINET (55)
[C10] FROM FROM SECONDARY EFF. PUMP NO. 2 TO MCC6 VIA CABINET (55)
[C10] FROM NITRIFICATION RECYCLE PUMP NO. 4 TO MCC6 VIA CABINET (55)
[C10] FROM NITRIFICATION RECYCLE PUMP NO. 2 TO MCC6 VIA CABINET (55)
[C10] FROM RECYCLE PUMP NO. 2 TO MCC6 VIA CABINET (55)
33 = [2"C, [SPARE]]
34 = [2"C, [SPARE]]
35 = [2"C, [SPARE]]
36 = [2"C, [SPARE]]

SHEET KEYNOTES

1. REFER TO DRAWINGS 06-E-6201 AND 06-E-6202. VERIFY CONFIGURATION OF EXISTING MOTOR STARTERS AND REQUIRED SIGNALS FOR NEW STARTERS. MODIFY THE QUANTITY OF SIGNAL CONDUCTORS AS NEEDED TO ACCOMODATE THE REQUIRED I/O.

NO.	DATE	REVISION	DR	CHK	APVD	BY	APVD
DSGN	R FURMANSKI		R FURMANSKI	D NICHOLSON			T TWIST

WRIGHT SMITH, JR.
WASTEWATER TREATMENT PLANT
ELECTRICAL, I&C AND HVAC MODIFICATIONS
MOBILE AREA WATER AND SEWER SYSTEMS
MOBILE, ALABAMA

Jacobs

ELECTRICAL
DUCTBANK SECTIONS

NTS
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2026
PROJ	D3755100
DWG	05-E-6001
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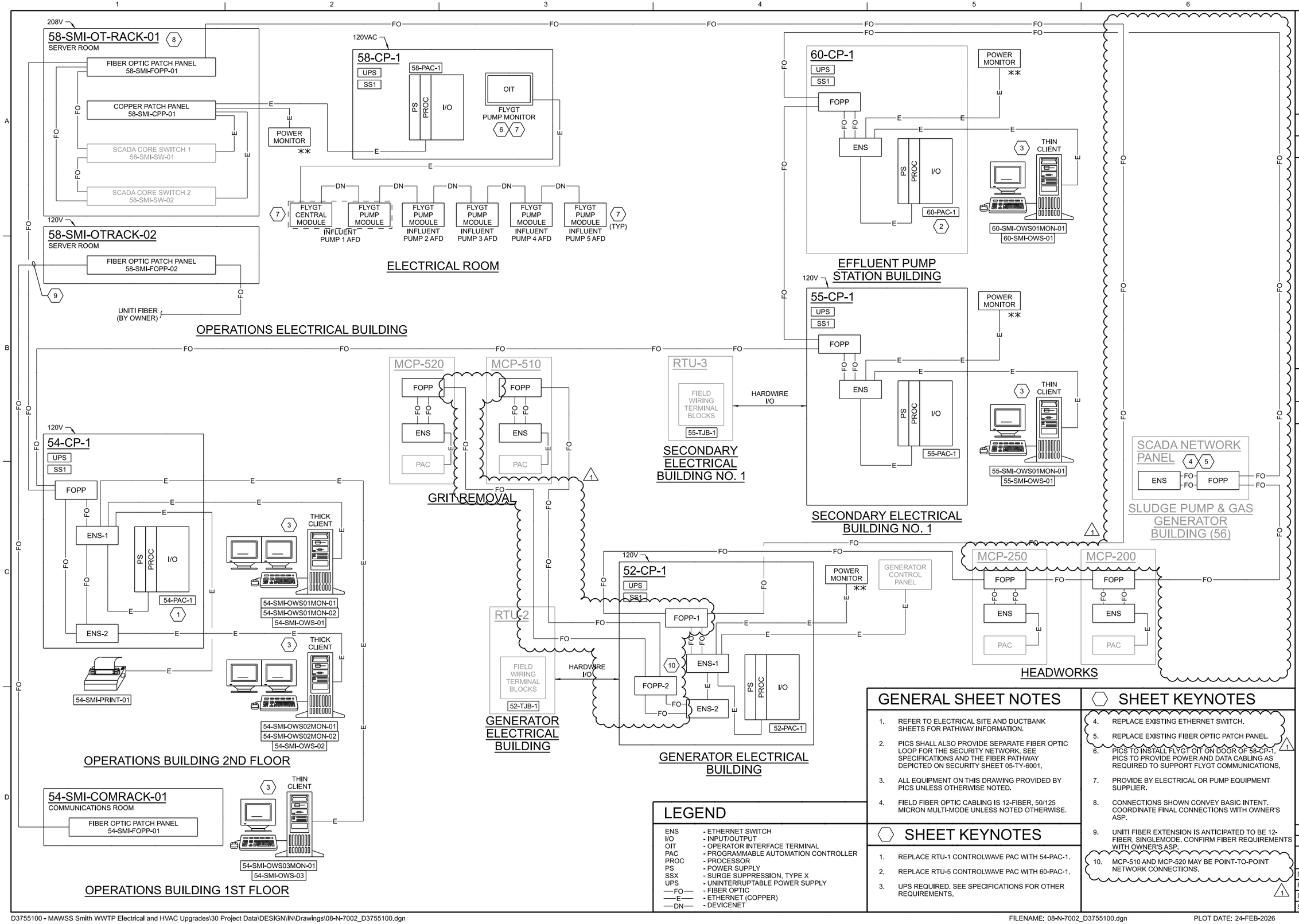
BID DOCUMENTS



GENERAL SHEET NOTES

1. REFER TO ELECTRICAL SITE AND DUCTBANK SHEETS FOR PATHWAY INFORMATION.
2. PICS SHALL ALSO PROVIDE SEPARATE FIBER OPTIC LOOP FOR THE SECURITY NETWORK. SEE SPECIFICATIONS AND THE FIBER PATHWAY DEPICTED ON SECURITY SHEET 05-TY-6001.
3. ALL EQUIPMENT ON THIS DRAWING PROVIDED BY PICS UNLESS OTHERWISE NOTED.
4. FIELD FIBER OPTIC CABLING IS 12-FIBER, 50/125 MICRON MULTI-MODE UNLESS NOTED OTHERWISE.

SHEET KEYNOTES

1. REPLACE RTU-1 CONTROLWAVE PAC WITH 54-PAC-1.
2. REPLACE RTU-5 CONTROLWAVE PAC WITH 60-PAC-1.
3. UPS REQUIRED. SEE SPECIFICATIONS FOR OTHER REQUIREMENTS.

SHEET KEYNOTES

4. REPLACE EXISTING ETHERNET SWITCH.
5. REPLACE EXISTING FIBER OPTIC PATCH PANEL.
6. PICS TO INSTALL FLYGT OIT ON DOOR OF 58-CP-1. PICS TO PROVIDE POWER AND DATA CABLING AS REQUIRED TO SUPPORT FLYGT COMMUNICATIONS.
7. PROVIDE BY ELECTRICAL OR PUMP EQUIPMENT SUPPLIER.
8. CONNECTIONS SHOWN CONVEY BASIC INTENT. COORDINATE FINAL CONNECTIONS WITH OWNER'S ASP.
9. UNITI FIBER EXTENSION IS ANTICIPATED TO BE 12-FIBER, SINGLEMODE. CONFIRM FIBER REQUIREMENTS WITH OWNER'S ASP.
10. MCP-510 AND MCP-520 MAY BE POINT-TO-POINT NETWORK CONNECTIONS.

LEGEND

ENS	- ETHERNET SWITCH
I/O	- INPUT/OUTPUT
OIT	- OPERATOR INTERFACE TERMINAL
PAC	- PROGRAMMABLE AUTOMATION CONTROLLER
PROC	- PROCESSOR
PS	- POWER SUPPLY
SSX	- SURGE SUPPRESSION, TYPE X
UPS	- UNINTERRUPTABLE POWER SUPPLY
—FO—	- FIBER OPTIC
—E—	- ETHERNET (COPPER)
—DN—	- DEVICENET

NO.	DATE	REVISION	DR	CHK	APVD
1	02/26	ADDENDUM NO. 3	G GRAY	A PASTRANA	C HARRIS

DSGN G GRAY | BY AP | APVD G GRAY | GG

WRIGHT SMITH, JR.
WASTEWATER TREATMENT PLANT
ELECTRICAL, I&C AND HVAC MODIFICATIONS
MOBILE AREA WATER AND SEWER SYSTEMS
MOBILE, ALABAMA

Jacobs

INSTRUMENTATION AND CONTROL
WRIGHT SMITH WWTP NETWORK BLOCK DIAGRAM

BID DOCUMENTS

NTS
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

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PROJ	D3755100
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