# Technical Specifications

The standard specifications for this project shall be the "New Mexico Standard Specifications for Public Works Construction" (Latest Edition).

The technical material and data contained in the specification were prepared by me or under the direction and supervision of the undersigned.


The following pages contain the special technical specifications to the project specifications.

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# SECTION 01 10 00

# SUMMARY OF WORK

## PART 1 -GENERAL

### 1.1 SECTION INCLUDES

A. Summary of Work
B. OWNER Supplied Products
C. Work Sequence

### 1.2 SUMMARY OF WORK

Municipal water system improvements including removal and installation of pump, piping, electrical, sump cleaning and associated improvements.

### 1.3 OWNER SUPPLIED PRODUCTS

A. OWNER's Responsibilities

1. Owner will separately contract for programming the motor soft start.

### 1.4 WORK SEQUENCE

A. Construct work in the following stages:

1. The Work may be accomplished as the CONTRACTOR chooses based on availability of supplies and subcontractors schedules. A suggested Construction Sequence is included in the drawings. Deviation from this should be coordinated with the City. All work must be completed before any segment is tied to the system.

END OF SECTION

# SECTION 01 40 00

# QUALITY CONTROL

## PART 1 – GENERAL

### 1.1 SECTION INCLUDES

1. Quality assurance and control of installation.
2. References.
3. Field samples.
4. Inspection and testing laboratory services.
5. Manufacturers' field services and reports.
6. Tolerances

### 1.2 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarifications from ENGINEER before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent specified tolerances, codes, or requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce workmanship of specified quality.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

G. Document and keep records of quality assurance/ control of installation.

### 1.3 REFERENCES

A. Conform to reference standard by date of issue current on date of Contract Documents. Dates specified in individual Sections supersede all other dates of issue.

B. Should specified reference standards conflict with Contract Documents, request clarification from ENGINEER before proceeding.

C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.4 FIELD SAMPLES

A. Install field samples at the site as required by individual Specification Sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by OWNER.

1.5 TESTING LABORATORY SERVICES

A. OWNER will provide inspection service for this project.

B. CONTRACTOR will select, pending approval by the OWNER, employ, and pay for services of an independent firm to perform testing.

C. The independent firm will perform tests and other services specified in individual Specification Sections and as required by the OWNER.

D. Reports will be submitted by the independent firm to the OWNER, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. CONTRACTOR shall cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.

1. Notify OWNER and independent firm 8 hours prior to expected time for operations requiring services.

2. Make arrangements with independent firm and pay for additional samples and tests required for CONTRACTOR’s use.

F. A partial list of field tests required on this project, parties responsible for conducting the tests, and parties responsible for payment of the tests is presented below. Where tests specified in other sections of these specifications are not listed below, the CONTRACTOR will request additional testing information from the OWNER.

- No field testing is anticipated.

## 1.6 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions and training of OWNER's personnel when necessary.

B. CONTRACTOR to report to OWNER material or product supplier's or manufacturer's observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 14 days of observation to OWNER and ENGINEER for review.

## 1.7 TOLERANCES

A. Monitor tolerance control of installed Products to produce acceptable work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturer's tolerances conflict with Contract Documents, request clarification from ENGINEER before proceeding.

C. Adjust Products to appropriate dimensions; position before securing Products in place.

# PART 2 – PRODUCTS

Not Used.

# PART 3 – EXECUTION

Not Used

# PART 4 - MEASUREMENT AND PAYMENT

Work covered in this Section of the Specifications and associated costs therewith shall be included in the contract price for the item to which the work applies. No separate payment shall be made.

END OF SECTION

# SECTION 01 70 00

# CONTRACT CLOSEOUT

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Adjusting.

D. Project record documents.

E. Operation and maintenance data.

F. Spare parts and maintenance materials.

### 1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for ENGINEER's review.

B. Provide submittals to ENGINEER that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

### 1.3 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

D. Clean filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.5 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, Product Data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by OWNER.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to finish [main] floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

## 1.6 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch text pages, binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed.

D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on 20 pound white paper, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of ENGINEER, CONTRACTOR, Subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
   a. Significant design criteria.
   b. List of equipment.
   c. Parts list for each component.
   d. Operating instructions.
   e. Maintenance instructions for equipment and systems.
   f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data.
   b. Air and water balance reports.
   c. Certificates.
   d. Photocopies of warranties and bonds

E. Submit 1 draft copy of completed volumes 15 days prior to final inspection. This copy will be reviewed and returned after final inspection with ENGINEER comments. Revise content of all document sets as required prior to final submission.

F. Submit two sets of revised final volumes, within 20 days after final inspection.

## 1.7 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.

B. Deliver to Project site, obtain receipt prior to final payment.

END OF SECTION

# SECTION 22 10 00

# PUMP HOUSE PLUMBING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Pump house water piping.
2. Unions and flanges.
3. Pipe hangers and supports.
4. Sleeves.
5. Pumps.

B. Related Sections:
1. Section 33 11 13 - Public Water Distribution Systems: Product and execution requirements for underground water piping.

### 1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.9 - Building Services Piping.

C. ASTM International:
1. ASTM A536 - Standard Specification for Ductile Iron Castings.

D. American Water Works Association:
1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Submittal

procedures. B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
2. Hangers and Supports: Submit manufacturers catalog information including load capacity.
3. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted.
   Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 00 00 - Product Requirements: Product storage and handling requirements.

B. Accept equipment on site in shipping containers with labeling in place. Inspect for damage.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GRADE

C. Ductile Iron Pipe: AWWA/ANSI C151/A21.51, centrifugally cast with push-on joints, of the diameter indicated, pressure Class 350, except that where mechanical couplings are used and the pipe is grooved, the ductile iron pipe shall be of special thickness Class 53.

1. Coating and Lining: AWWA/ANSI C104/A21.4, double cement lined and bituminous coated, polyethylene interior lining of 40 mils. in the barrel area, and
   10 mils. minimum elsewhere.
2. Fittings: ANSI/AWWA C1/A21.11, mechanical joint ends, double cement lining and bituminous coating conforming to ANSI/AWWA C104.A21.4, mechanical joint accessories unless specified others, with high strength low alloy steel bolts and heavy hexagon nuts conforming to ANSI/AWWA C111.A21.11. Fittings will be marked with pressure rating, nominal diameter of opening, manufacturers identification, country where cast, and degree of bend.
3. Joints: Mechanical, push-on joints, flanged joints and restrained joints as required.
   a. Mechanical and push-on joints shall conform to ANSI/AWWA C111/A21.11.
   b. Flanged joints shall conform to ANSI/AWWA C115/A21.15.
   c. Mechanical joints conforming to ANSI/AWWA C-111/A21.11. Pressure rating will be 250 psi.
   d. Restrained joints shall be "Lok-Ring" Restrained Joint by American Ductile Iron Pipe, "TR FLEX" Restrained Joint by U.S. Pipe, "Mechanical Lock Joint" by Pacific States Cast Iron Pipe Company, Meg-A-Lug wedge action joint restraint Series 1100 for cast iron or ductile Series 1100 PV for cast iron size PVC (typical), or equal.
   e. Gasket: ASTM D2000, elastomer composition.
   f. Accessories: Stainless steel bolts, nuts, and washers.

## 2.11 PUMPS

A. Pump shall be a Gorman-Rupp Model S6B1-E95 consisting of a single stage, submersible pump, electric motor assembled in a single body.

B. Discharge flange shall be Gray Iron 30.

C. Pump shall be designed to handle raw water at an operating point of 1600 GPM at 100 feet.

D. Stainer: Urethane coated steel with 1” openings.

E. Motor: Oil filled enclosure; 95 H.P.; 1750 R.P.M.; Inverter Duty Rated (VFD Capable). Three Phase: 460/575 Volt, 60 Hz, 116/93 Full Load AMPS, 72.0 kW (Max.)

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Coordination and project conditions.

### 3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.

### 3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Inserts:
   1. Provide inserts for placement in concrete forms.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above flush with top of recessed into and grouted flush with slab.

B. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708 and MSS SP 89.
   2. Support horizontal piping as schedule.
   3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   7. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
   8. Provide copper plated hangers and supports for copper piping sheet lead packing between hanger or support and piping.
   9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
   10. Provide hangers adjacent to motor driven equipment with vibration isolation.

## 3.4 INSTALLATION - ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange systems to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not accessible.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

L. Install domestic water piping in accordance with ASME B31.9.

M. Sleeve pipes passing through partitions, walls and floors.

N. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

O. Install unions downstream of valves and at equipment or apparatus connections.

P. Install valves with stems upright or horizontal, not inverted.

Q. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

R. Install gate ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers, if applicable.

S. Install globe ball or butterfly valves for throttling, bypass, or manual flow control services, if applicable.

T. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

U. Provide spring loaded check valves on discharge of water pumps, if applicable.

V. Provide flow controls in water circulating systems as indicated on Drawings, if applicable.

W. Install potable water protection devices on plumbing lines where contamination of domestic water may occur.

X. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

3.5 INSTALLATION - PUMPS

A. Install pumps per manufacturer's instructions and as indicated on the Drawings.

3.6 CLEANING

A. Prior to starting work, verify system is complete, flushed and clean.

END OF SECTION

# SECTION 26 05 00
# COMMON WORK RESULTS FOR ELECTRICAL

## PART 1 GENERAL

### 1.1 SCOPE

A. This section includes administrative items related to submittals, permits, substitutions, owner training, project closeout, and general requirements for performance of work by the Division 26 contractor. Reference Division 1 for other requirements.

### 1.2 SUBMITTAL REQUIREMENTS – DIVISION 26

A. Engineer will commence review only when all Division 26 submittals have been received, due to interrelations between different sections. Review may be delayed if certain other related divisions have not been received, for example elevators or HVAC equipment.

B. Organize submittals by section and name files with section number and title.

C. All data required for review must be contained in the files provided to the Engineer. Links to manufacturer's websites will not be accepted.

D. Re-submittals must contain markups that clearly delineate the changed items. Engineer will not re-review the entire submittal package in order to find the changes.

E. Electronic submittals (pdf format) are preferred and can be reviewed faster. Paper submittals will also be accepted, but mixed format submittals are not acceptable.

F. No fabrication or work which requires submittals shall begin until submittals are returned with the Engineer's approval.

G. The Contractor shall coordinate each submittal with the requirements of the Work and of the Contract Documents. In the event that significant deviations are necessary between the submittals and the Contract Documents, he shall notify the Engineer in writing at the time of submission.

H. The Contractor shall visit the project site, verify dimensions and existing conditions as far as possible without beginning work, and coordinate submittals accordingly. In the event that significant deviations are found between the existing conditions and the Contract Documents, he shall notify the Engineer in writing at the time of submission.

I. Engineer's review does not constitute acceptance or responsibility for accuracy of dimensions, and will not relieve the Contractor from responsibility for errors or omissions in the Shop Drawings.

J. Engineer's review does not relieve the Contractor of any requirements in the Contract Documents, nor shall it constitute approval of any deviation from the Contract Documents, unless such deviations are specifically stated by the Engineer in the submittal review.

### 1.3 PERMITS

A. Permits necessary for the performance of the work under this contract shall be secured and paid for by the Contractor. Final inspection by the Engineer will not be made or certificate of final payment issued until certificates of satisfactory inspection from the inspection authorities are delivered. Reference Division 1 for permit requirements.

### 1.4 SUBSTITUTIONS

A. <u>All proposed product substitutions must be submitted for approval prior to bidding</u>. Refer to Division 1 for substitution request deadline.

B. Substitution reviews will be issued in Addenda to all bidders, no later than final Addendum before bid due date.

C. Refer to the appropriate specification section for detailed requirements for each type of product.

D. Bidder is required to document each substitution request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. Equipment and materials indicated in the Contract Documents form the Basis of Design for this project. Substitute products proposed by the bidder must equal the specified products in dimension, configuration, weight, electrical requirements, performance, etc.

F. Any project design revision necessary to accommodate a substitute product will be the responsibility of the contractor. These revisions may be reflected in a shop drawing prepared by the contractor and approved by the Engineer. In the event that redesign is required by the Engineer, contractor shall be responsible for Engineer's fees to do so.

G. Any impact to other Divisions created by a Division 26 product substitution shall be clearly described on the substitution request for consideration by the design team. General Contractor shall provide an estimate of associated cost impact to other Divisions where applicable.

**1.5 TRAINING**

A. The electrical contractor shall conduct a 4 hour minimum training session with owner's designated staff to review all electrical equipment installed under this contract. At a minimum, the session will include operation and maintenance, programming, and basic operation of the systems.

B. Contractor shall physically demonstrate the operation of each piece of equipment.

C. A sign in sheet and agenda indicating a list of all equipment reviewed shall be included in the close out documents.

**PART 2 DIVISION 26 SCOPE**

**2.1 ELECTRICAL WIRING AND CONTROL EQUIPMENT**

A. All line voltage wiring and conduit systems required by any Division shall be the responsibility of the Division 26 contractor. Every attempt will be made to reflect these requirements on the electrical sheets, but it is the Division 26 contractor's responsibility to obtain a complete drawing set, familiarize himself with the complete project scope, and coordinate with other Divisions.

B. Responsibilities of the Division 26 contractor include but are not limited to:

1. Installation and wiring of variable frequency drives (VFDs furnished by Division 23, startup and programming of VFDs shall be by VFD manufacturer's representative)
2. Wiring to duct smoke detectors, including signal wiring to fire alarm system
3. Wiring to fire/smoke dampers, including signal wiring and provision of disconnecting means at dampers
4. Raceways for control circuits in all Divisions
5. Field wiring of motor overload protection and starters (where required by equipment manufacturer)
6. Field wring of integral transformers in equipment (where required by equipment manufacturer)

C. The Division 26 Contractor must coordinate with the Division 23 Contractor regarding the requirements of electrical control components. Any changes or additions required due to the specific nature of equipment furnished shall be the complete responsibility of the Contractor furnishing the equipment.

D. The Division 26 Contractor must coordinate with the Division 23 Contractor to ensure that all required components of control systems are included and fully understood. The Owner shall not incur any additional cost as a result of lack of such coordination.

**PART 3 EXECUTION**

**3.1 EXISTING CONDITIONS**

A. The Contractor shall carefully examine the drawings and specifications, visit the site of the work, fully inform himself as to all existing conditions, dimensions and limitations before starting work.

B. If discrepancies are found between existing conditions and Contract Documents, Contractor shall notify Engineer for direction before proceeding. No claim for additional cost or time extension will be allowed without proper notice plus prior determination of time and cost to the owner.

C. If existing active or non-active services (which are not shown on plans) are encountered that require relocation or disconnection, the Contractor shall notify the Engineer for a decision on proper handling of these services. The Contractor shall not proceed with the work until so authorized.

D. Damage to existing improvements caused by the contractor or a party to the contractor during the demolition or construction phase shall be repaired prior to contract date of substantial completion at no additional expense to the owner.

**3.2 DEMOLITION AND MODIFICATION OF EXISTING SYSTEMS**

A. The demolition plan shall be used as a schematic guide. Additional demolition may be required to complete the work indicated on the Contract Documents. If additional demolition scope is required, notify Engineer for direction before proceeding.

B. If concealed conditions are found that are of an unusual nature not ordinarily encountered in work of this kind, and these conditions will impact the cost, schedule, or design of the project, notify Engineer for direction before proceeding. No claim for additional cost or time extension will be allowed without proper notice plus prior determination of time and cost to the owner.

C. Division 26 contractor is responsible for disconnection of all electrical systems in walls, floors, and ceilings scheduled for removal in the Contract Documents.

D. Division 26 contractor is responsible for provision of temporary wiring and connections when required to maintain existing systems in service during construction.

E. Verify that all electrical equipment to be relocated or reused is in working order prior to removal. If the existing material is found to be deficient, contractor shall notify Engineer for direction before proceeding.

F. When performing work on energized equipment or circuits, use personnel experienced and trained in similar operations.

G. Coordinate with general contractor for repair of adjacent construction and finishes damaged or exposed during demolition work. Repairs shall match existing finishes, and include paint on entire wall where required to match color.

H. Unless otherwise noted in drawings, all existing removed equipment shall be stockpiled at the site at a location approved by Owner until an inspection by the Owner's representative determines what will be salvaged. All equipment not salvaged shall be properly disposed of off-site by Contractor.

I. Division 26 contractor is responsible for properly disposing of existing hazardous materials removed under Division 26, including but not limited to:

1. Fluorescent Lamps: remove from the site and properly disposing of them with a fluorescent lamp recycling company. Any used bulbs should be removed and placed in a new fluorescent lamp cardboard container. The cardboard container should be properly labeled. Boxes shall be stored and handled so that the used fluorescent lamps will not be crushed.

2. Lighting Ballasts: Inspect ballasts to be removed. Ballasts with a “No PCB” label may be disposed of as normal construction debris. Ballasts without a “No PCB” label shall be assumed to contain PCBs:

   a. Non-leaking ballasts with PCBs shall be disposed of at a landfill that will accept them. If no such landfill is available, treat as leaking below.

b. Leaking ballasts shall be transported off-site by a PCB transporter to an EPA-approved chemical processing site.

## 3.3 PERFORMANCE OF NEW WORK

A. Provide, install, and coordinate all Division 26 work indicated by Contract Documents. This consists of furnishing all labor, equipment, supplies and materials in addition to performing all operations including cutting, channeling and underground trenching, back fill and tamping necessary for the installation of complete power, lighting, or other systems as shown.

B. Perform all electrical work in a neat and workmanlike manner in full compliance with all applicable, adopted codes; including, but not limited to: the national electrical code (NEC), UBC, IBC, NFPA, and ADA. all local and state requirements will be observed during the performance of this work.

C. If any if discrepancies are found between Contract Documents and any associated legal or safety requirements, Contractor shall notify Engineer in writing. The Engineer will modify the Contract Documents as required. If the Contractor proceeds with any work he knows to be in variance of legal or safety requirements, the Contractor will assume all responsibility for this work. He will promptly correct the work when notified, without additional cost to the Owner.

D. Coordinate all phases of the electrical work with the Architect and General Contractor. Schedule work to minimize disruption and inconvenience to the Owner.

E. Obtain from system suppliers all wiring diagrams for all equipment and ensure that manufacturer’s electrical requirements are met. Any incorrect wiring or devices installed by Contractor without the wiring diagram shall be corrected at Contractor's expense.

F. Obtain permission from Structural Engineer before drilling or cutting structural members.

G. Contact utility companies (power, gas, water, sewer, telephone, cable tv, etc.) prior to trenching in order to identify underground utilities. Contractor shall locate secondary service feeders, underground electrical branch circuits, sprinkler lines, etc., prior to trenching. Any cut or damaged underground utilities shall be repaired or replaced at Contractor's expense.

H. When installing service equipment or metering equipment, coordinate with utility company to ensure that their standards are being met. If any discrepancy is found between utility standards and Contract Documents, notify Engineer for direction.

I. Coordinate exact locations of electrical components and connections:

1. Where devices are shown in casework, coordinate exact locations with architectural casework details prior to rough-in.
2. Verify final locations of all sinks with the plumbing contractor prior to rough-in of nearby electrical devices. Any above counter electrical devices found within 8” of a sink, and any disposal receptacles found outside the under-sink space, shall be relocated at electrical contractor's expense.
3. The owner reserves the right to relocate any electrical device up to a distance of 12", prior to installation, without additional charge.
4. Coordinate the exact location of equipment requiring electrical connections with other trades prior to rough in. Where there is a question of adequate clearance or coordination between trades, Contractor will submit dimensioned drawings for Engineer's review prior to rough in.

## 3.4 ELECTRICAL PROJECT CLOSE OUT REQUIREMENTS

A. Before substantial completion can be granted, the following items must be completed:

1. AHJ inspection shall be completed and work approved
2. All Division 26 equipment shall be installed and connected
3. All Division 26 systems shall be online, tested, adjusted and calibrated

4. Engineer's substantial completion inspection shall be performed

B. Prior to consideration of Final Payment, the Contractor shall:

1. Provide typed panel directories installed in each panelboard. Directories shall not be printed from drawings unless all circuiting is identical to that shown in drawings.
2. Have all electrical equipment labeled per requirements in 26 05 53
3. Provide Record As-Built Drawings to Engineer. As-Built Drawings shall consist of clear, legible markups of the Contract Documents indicating the following:
   a. Any installed circuiting that deviates from circuiting on plan
   b. Any equipment size or locations that deviate from plan
   c. Any other significant deviations from design
4. Provide copies of permits and/or inspection certificates.
5. Provide Operating and Maintenance Manual(s).
6. Return keys to the Owner.
7. Deliver all spare parts.
8. Touch up any damaged finishes.
9. Clean all affected electrical equipment and systems as needed to remove construction debris such as paint, dust, grease, etc.
10. Remove all existing equipment labels that are no longer accurate.

**END OF SECTION**

**SECTION 26 08 00**
**COMMISSIONING OF ELECTRICAL SYSTEMS**

PART1-GENERAL

1.01 DESCRIPTION

A. The purpose of this section is to specify the Division 26 Contractor's responsibilities and participation in the commissioning process.

B. Related Sections:

1. Section 01 91 13 – General Commissioning Requirements

2. Division 26 – Electrical

C. Commissioning is primarily the responsibility of the Commissioning Authority (CxA), with support and coordination for start-up, testing, and commissioning the responsibility of Division 26. The commissioning process does not relieve Division 26 from participation in the process or diminish the role and obligations to complete all portions of work in a satisfactory and fully operational manner meeting the design objectives of the Contract Documents, nor does it shift that responsibility partially to the CxA or another party.

D. The CxA will verify and document the following field tests and observations:

1. Point-to-Point Testing (PTP): Verification of all points of integration between the commissioned equipment and their respective centralized controller(s).
2. Functional Performance Tests (FPT). Functional system tests that verify all systems are functioning and interacting with other systems correctly.

E. Work of Division 26 includes:

1. Providing Contractor submittals to the CxA.
2. Testing and start-up of the equipment including documentation that PFC's have been completely and properly implemented.
3. Providing qualified personnel for participation in commissioning tests, including FPT's and seasonal testing required after the initial commissioning.
4. Providing equipment, software, materials, and labor necessary to correct deficiencies found during the commissioning process, which fulfill contract and warranty requirements.
5. Providing manufacturer's equipment installation instructions, Operation & Maintenance manuals, as-built drawings and any other reasonable requests for information by the CxA necessary to fully commission the systems.
6. Providing review and comment on the Functional Performance Tests (FPT's) developed by the CxA prior to implementation by the Contractors.
7. If Division 26 includes a central lighting control system, providing operational trend data. Configure and initiate trends of I/O points corresponding to all systems outlined in the Commissioning Plan. Trended data shall be provided to the CxA in graphical format and/or in Microsoft Excel format as defined in the Commissioning Plan. Providing training for the systems specified in Division 26 per the Contract Documents.
8. If Division 26 includes a central lighting control system, the lighting control system Contractor shall assist and cooperate with the CxA to establish a plan for the use of the system as part of commissioning activities. The Contractor shall provide a qualified technician to configure and initiate trends of control points as outlined in the Commissioning Plan. Trended data shall be provided to the CxA in graphical format and/or in Microsoft Excel format as defined in the Commissioning Plan.

**F. In the event of a conflict between this and other Sections of the Contract Documents, the more rigorous requirement shall apply.**

1.02 ABBREVIATIONS

A. The following abbreviations are utilized throughout this section:

**ASI** – Architects Supplemental Instructions

**BAS** – Building Automation System

**Cx** – Commissioning

**CxA** – Commissioning Authority

**FIV** – Field Installation Verification

**FPT** – Functional Performance Test

**GC** – General Contractor

**HVAC** – Heating, Ventilating and Air Conditioning

**O&M** – Operations & Maintenance

**PFC** – Pre-Functional Checklist

**PTP** – Point-To-Point

1.03 SCOPE OF WORK

A. The following electrical systems will be commissioned on this project in the Base and Alternate scopes of work as follows:
   1. Install new motor.
   2. Wiring for new motor.

1.04 COOPERATION

A. Contractors shall cooperate with the commissioning process in the following manner:

   1. Attend all commissioning process meetings as scheduled by the CxA and/or the General Contractor (GC).
   2. Complete equipment and system start up in accordance with the commissioning schedule.
   3. Allow sufficient time before final completion dates so that Functional Performance Testing (FPT) can be accomplished.
   4. Provide labor and material to make corrections when required without undue delay.

PART2-PRODUCTS

2.01 TEST EQUIPMENT

A. The Division 26 Contractor for the equipment being commissioned provides all standard or proprietary testing equipment required to perform startup and initial checkout (PFC's) and Functional Performance Tests (FPT's). The Division 26 Contractors shall provide two-way radios as necessary.

B. Proprietary test equipment (hardware, software, or tools available only from equipment manufacturer) and required for system commissioning, whether specified or not, shall be provided by the Division 26

C. Contractor. The Contractor and/or equipment manufacturer shall demonstrate its use and assist the CxA in the commissioning process. Proprietary test equipment shall be included in the base bid price of the equipment and become the property of the Owner upon completion of commissioning.

D. All instrumentation shall meet the following standards:
   1. Be of sufficient quality and accuracy to test and/or measure system performance within the tolerances required to determine adequate performance.
   2. Be calibrated on the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument being used.
   3. Be maintained in good repair and operating condition throughout the duration of use on this project.
   4. Be recalibrated/repaired if dropped and/or damaged in any way during use on this project.

PART3-EXECUTION

3.01 WORK PRIOR TO AND DURING EQUIPMENT STARTUP

A. The Contractors shall comply with all requirements within the manufacturer's installation, startup, and checkout manuals.

B. Complete all phases of work so the system can be started, tested, and otherwise commissioned. Division 26 has primary startup responsibilities with obligations to complete systems, including all sub-systems so they are functional. This includes the complete installation of all equipment, materials, wire, controls, software, etc. per the Contract Documents and related directives, clarifications, change orders, etc.

C. A Commissioning Plan including Functional Performance Tests (FPT's) for each piece of commissioned equipment will be developed by the CxA. Upon request of the CxA, Contractors shall provide assistance and consultation. Prior to normal submittals and before commencement of construction activities, Contractors are obligated to assist the CxA in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. This requirement does not relieve the Contractors of any of their standard submittals required per Contract Documents. This information will typically include, but is not necessarily limited to:

   1. Installation, startup and checkout instructions including those that typically ship with the unit
   2. Standard field checkout sheets or forms to be used by the factory of field technicians
   3. Operation & Maintenance instructions
   4. Warranty information including any requirements or responsibilities of the Owner to keep the warranty in force clearly identified

D. Contractors shall review the FPT's and provide comments back to the CxA with respect to feasibility, safety, equipment protection, and any potential effect the tests may have on equipment warranty.

E. Through normal channels of communication, Contractors shall notify the GC, Design Professionals, and CxA of any areas where the Contract Documents appear to have discrepancies or do not contain enough

detail for them to properly perform their work. Contractors shall assist the Design Professionals in the resolution or clarification of these issues.

F. If Division 26 includes a central lighting control system, the PFC shall include electrical continuity checking, elimination of ground faults, point-to-point test, test of scheduled operation, interlocks, alarms, etc. and complete testing of all software and hardware to render fully operational control systems.

G. If Division 26 includes a central lighting control system, the lighting control system Contractor shall supply the CxA with the following:

1. Two (2) debugged printouts of all system software, including all user's programming and engineering manuals required to interpret the software. Included in the printouts, though not limited to, shall be the following:
   a. Point database
   b. Initial schedules for lighting control
   c. System graphics

H. The Contractors shall provide all services required to bring each system into a fully operational state.

I. If Division 26 includes a central lighting control system, point-to-point tests shall be completed and documented by the lighting control system Contractor and reviewed by the CxA prior to being field verified by the CxA. The lighting control system Contractor shall assume that each point will be field verified by the CxA and a Contractor technician. **While performing point-to-point verifications, if it is determined that work was not completed as documented by the lighting control system Contractor, the CxA shall notify the GC and the point-to-point verification process shall be stopped. The lighting control system Contractor shall then be responsible for repeating their point-to-point tests and documentation and shall be backcharged for any and all subsequent visits by the CxA to complete the point-to-point verification process at their standard hourly rates plus expenses. The cost of the additional work shall be deducted from the contract amount stated in the agreement between the Owner and the General Contractor.**

1. The Contractor shall provide complete, debugged and **blank** I/O summary of all points indicated in the construction documents for review. This document shall include the following at a minimum (also see example format below):

   a. I/O Point Name

   b. I/O Point Type

   c. Cable Tag

   d. Device Connected

   e. Statuses to be Verified

      (i) Centralized Controller Value(s)

      (ii) Field Measured Value(s)

   f. Initials of Contractor who Performed Verification(s)

   g. Date when Verifications were Performed

| I/O Point Name | Point Type | Device Connected | Controller Status | Measured Field Status | Date | Chk By |
|---|---|---|---|---|---|---|
| Office 101 | BO | Zone 1 Lights | ON/OFF | | | |

2. After review of the blank forms by the CxA, the Contractor shall **complete** the PTP checkout and submit to the Commissioning Authority for review. The PTP checkout should be performed from the completed graphic interface to the physical field location. This completed PTP checkout should include the following elements completed (also see example format below):

   a. Centralized Controller Value(s)

   b. Field Measured Value(s)

   c. Initials of Contractor who Performed Verification(s)

   d. Date when Verifications were Performed

| I/O Point Name | Point Type | Device Connected | Controller Status | Measured Field Status | Date | Chk By |
|---|---|---|---|---|---|---|
| Office 101 | BO | Zone 1 Lights | ON/OFF | ON/OFF | 1/1 | JD |

3. After review of the completed forms by the CxA, the Contractor shall repeat selections the PTP checkout in the presence of the Commissioning Authority for verification. This completed PTP checkout should include the following elements completed (also see example format below):

   a. Additional Column with the CxA's Initials

| I/O Point Name | Point Type | Device Connected | Controller Status | Measured Field Status | Date | Chk By | CxA |
|---|---|---|---|---|---|---|---|
| Office 101 | BO | Zone 1 Lights | ON/OFF | ON/OFF | 1/1 | JD | QEG |

## 3.02 FUNCTIONAL PERFORMANCE TESTING

A. Functional Performance Testing is the dynamic testing of systems, rather than just individual components or systems. The CxA develops the Functional Performance Tests (FPT's) in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing Contractor or vendor. In the case of simpler systems to be commissioned such as occupancy sensors for lighting control, the CxA may perform the FPT's without written forms or direct Contractor involvement through the use of dataloggers or manual testing to document system performance.

B. If Division 26 includes a central lighting control system, the lighting control system Contractor shall be responsible for providing operational trend data as part of the FPT documentation. The Contractor shall configure and initiate trends of I/O points corresponding to all systems outlined in the Commissioning Plan and as defined in the FPT's. Trended data shall be graphed and provided to the CxA in digital ".pdf" format for review and comment as defined in the Functional Performance Test procedures. Though not common, the CxA may also request data to be provided in a ".csv" format for import to a spreadsheet program.

C. The Contractors have been provided an opportunity to review and comment on the FPT's developed by the CxA. The Contractor shall repeat, at no additional cost to the Owner, the complete FPT procedure until acceptable results are achieved. **The Owner shall not be required to accept the systems and the warranty period shall not begin until acceptable FPT results are achieved. The CxA shall provide a review of one test for each system. If the test fails because the system does not perform as designed, the Contractor shall correct the deficiency and the system will need to be retested. The Contractor shall be backcharged for additional labor and expenses incurred by the CxA in repeating the failed test at their standard hourly rates plus expenses. The cost of the additional work shall be deducted from the contract amount stated in the agreement between the Owner and the General Contractor.**

3.03 PARTICIPATION IN COMMISSIONING

A. Provide skilled technicians to start-up and debug all systems within Division 26. These same technicians shall be made available to assist the CxA in completing the commissioning process as it relates to each system and their technical specialty. Work schedules, time required for testing, etc. will be requested by the CxA and coordinated through the GC. Contractors will ensure the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustment, and/or problem resolutions.

B. The CxA reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or subsystem. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the CxA to get the job done. A liaison or intermediary between the CxA and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.

3.04 WORK TO RESOLVE DEFICIENCIES

A. In some systems, poor adjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Architect, with input from the Contractors, Engineers, equipment suppliers, and CxA. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Architect per Division 01 will have final jurisdiction on the necessary work to be done to achieve performance, with acceptance by the Owner.

B. Corrective work is to be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to render system performance will be permitted. If the CxA deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the CxA will notify the Architect indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

3.05 SYSTEMS DOCUMENTATION

A. In addition to requirements that may be defined elsewhere in the Contract Documents:

1. Prepare a minimum of (3) completed copies of final O&M manuals for the Owner in addition to a digital copy in ".pdf" format. If not already stated in the O&M manual for each piece of commissioned equipment, a recommended schedule of requirements and maintenance frequency shall be provided by the Contractor and/or the manufacturer.
2. Maintain as-built "redlines". "Redlined" drawings developed upon completion of construction, based on memory of key personnel, shall not be satisfactory. Continuous and regular "redlining" of drawings is considered essential and mandatory. Provide a digital copy to the Owner in ".pdf" format.
3. Update the Contract Documents to incorporate field changes and revisions to system designs to account for actual constructed configurations. Division 26 as-built drawings shall include architectural floor plans, elevations and details, and the individual mechanical or electrical systems in relation to actual building layout.
4. If the project includes a central lighting control system, the lighting control system Contractor shall also include a completed set of as-built shop diagrams for the system. Provide a digital copy to the Owner in ".pdf" format. The as-built diagrams shall include, but are not necessarily limited to:
   a. Updated and clarified modes of operation documenting actual programmed configuration and initial setpoints
   b. Updated control diagrams and schematics
   c. Final I/O summary including both physical and virtual points

d. Locations of all field sensors such as ceiling mounted occupancy sensors or sensors measuring lighting levels for dimming control clearly identified on the as-built building floor plans
e. Network and communications trunk wiring schematics overlaid upon building floor plans and indicating locations of each controller in the system

**END OF SECTION**