

## APPENDIX M

### SECTION 01001

### BASIC REQUIREMENTS

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### BASIC REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

###### SUMMARY OF WORK

- 1.2 Contract description.
- 1.3 Work by Owner
- 1.4 Contractor's use of premises.
- 1.5 Specification Conventions

###### PRICE AND PAYMENT PROCEDURES

- 1.6 Schedule of values.
- 1.7 Applications for payment.
- 1.8 Change procedures.

###### ADMINISTRATIVE REQUIREMENTS

- 1.9 Coordination.
- 1.10 Pre-construction/Pre-installation Meetings.
- 1.11 Progress meetings
- 1.12 Equipment electrical characteristics and components.
- 1.13 Cutting and patching.

###### SUBMITTALS

- 1.14 Submittal procedures.
- 1.15 Construction progress schedules.
- 1.16 Shop drawings.
- 1.17 Manufacturer's instructions.
- 1.18 Manufacturer's certificates.

###### QUALITY REQUIREMENTS

- 1.19 Quality control.
- 1.20 Tolerances.
- 1.21 References.
- 1.22 Testing and inspection laboratory services.
- 1.23 Manufacturer's field services and reports.
- 1.24 Examination.
- 1.25 Preparation.

##### TEMPORARY FACILITIES AND CONTROLS

- 1.26 Temporary electricity.
- 1.27 Temporary lighting for construction purposes.
- 1.28 Heating and cooling.
- 1.29 Ventilation.
- 1.30 Telephone and facsimile service.
- 1.31 Sanitary facilities.
- 1.32 Field offices and sheds.
- 1.33 Access roads.
- 1.34 Parking.
- 1.35 Progress cleaning and waste removal.
- 1.36 Barriers and fencing.
- 1.37 Enclosures.
- 1.38 Protection of existing facilities.
- 1.39 Removal of utilities, facilities, and controls.

##### PRODUCT REQUIREMENTS

- 1.40 Products.
- 1.41 Delivery, handling, storage, and protection.
- 1.42 Substitutions.

##### EXECUTION REQUIREMENTS

- 1.43 Closeout procedures.
- 1.44 Final cleaning.
- 1.45 Starting of systems.
- 1.46 Demonstration and instructions.
- 1.47 Testing, adjusting and balancing.
- 1.48 Protecting installed construction.
- 1.49 Project record documents.
- 1.50 Operation and maintenance data.
- 1.51 Spare parts and maintenance materials.
- 1.52 Warranties.

## 1.2 CONTRACT DESCRIPTION

- A. Work of the Project includes the removal and replacement of the existing HVAC DDC system. This includes ALL items to make it a fully functional system.
- B. Perform Work of Contract under a stipulated sum contract with the Owner in accordance with the Conditions of Contract.
- C. The Contractor shall furnish all materials, labor, plant and equipment necessary to complete the contract work as called for by the Technical Specifications and as indicated on the Drawings. Material and work, either expressed or implied, necessary for the satisfactory completion of the contract work shall be considered an integral part thereof.

## 1.3 WORK BY OWNER

- A. Owner will be responsible for notification of all tenants, and matters dealing with press/public relations.

## 1.4 CONTRACTOR'S USE OF PREMISES

- A. Limit use of site and premises to allow:
  - 1. Owner occupancy.
  - 2. Work by others.
  - 3. Use of site and premises by public and judicial complex personnel.
- B. Access to Site: Limited to:

All work shall be performed during regular work hours of personnel: 7 a.m. - 3:30 p.m., Monday through Friday. No work shall be performed outside these hours unless approved by owner.

  - 1. Owner will arrange access to the facility, but will not provide keys.
- C. Time restrictions for performing Interior Work:
- D. Utility outages and shutdown: Contractors will coordinate any outages or shutdowns 7 working days in advance.
- E. The contractor shall make every effort to minimize noise caused by his operations.

## 1.5 SPECIFICATION CONVENTIONS

- A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference.

## 1.6 SCHEDULE OF VALUES

- A. Submit schedule on AIA Form G703 or EJCDC Form 1910-8-E. Contractor's standard form or electronic media printout will be considered.
- B. Submit Schedule of Values at time of first Application for Payment.

## 1.7 APPLICATIONS FOR PAYMENT

- A. Submit three copies of each application on AIA Form G702 and G703 or EJCDC Form 1910-8-E.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Payment Period: Monthly.

## 1.8 CHANGE PROCEDURES

- A. Stipulated Sum/Price Change Order: Based on Contractor's Contractor's request for a Change Order as approved by Architect/Engineer.
- B. Change Order Forms: AIA G701 or EJCDC 1910-8-B.

## 1.9 COORDINATION

- A. Due to the nature of activity at the building, the Contractor shall be required to carefully schedule work with the building occupants' representative. No work shall be performed without an approved schedule from the representative. The Owner will continue to occupy and use the buildings during the period of construction. Any work which will, in the Contractor's opinion, require coordination with Owner's staff and/or services shall be scheduled through the Owner's representative. This includes any shut down of power, utilities, heating, cooling, ventilation, etc. Contractor shall provide and employ protection for all areas and areas adjacent to that in which he is working.
- B. It shall be the responsibility of each trade to fully examine the documents and understand the full scope of work. The Prime contractor shall be responsible for coordinating all work by his own company and the subcontractors to provide a complete system. It shall further be the responsibility of each trade to coordinate his work with the work of other trades.
- C. Verify utility requirement characteristics of operating equipment are compatible with building utilities.
- D. Contractor is responsible for timely scheduling of pertinent inspections with local, county and state agencies with jurisdiction, and as required by the permits.
- E. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable.
- F. In finished areas, conceal pipes, ducts, and wiring within the construction.

## 1.10 PRECONSTRUCTION/ PRE-INSTALLATION MEETINGS

- A. Engineer will schedule a Pre-construction meeting for all affected parties.
- B. When required in individual specification section, convene a Pre-installation meeting at Project site prior to commencing work of the section.

## 1.11 PROGRESS MEETINGS

- A. The frequency of progress meetings will be determined at the preconstruction conference.



- B. M & E Engineering will preside at meetings, record minutes, and distribute copies within two days to those affected by decision making.

#### 1.12 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Motors: NEMA MG1 Type; specific motor type is specified in individual specification sections.
- B. Wiring Terminations: Terminal lugs to match branch circuit conductor; size terminal lugs to NFPA 70.
- C. Cord and Plug: Minimum 6 foot cord and plug including grounding connector; cord of longer length is specified in individual sections.

#### 1.13 CUTTING AND PATCHING

- A. Employ a skilled and experienced installer to perform cutting and patching new Work; restore Work with new Products.
- B. Submit written request in advance of cutting or altering structural or building enclosure elements.
- C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
  - 1. Fit the several parts together, to integrate with other Work.
  - 2. Uncover Work to install or correct ill-timed Work.
  - 3. Remove and replace defective and non-conforming Work.
  - 4. Remove samples of installed Work for testing.
  - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Cut masonry and concrete materials using masonry saw or core drill. Restore Work with new Products in accordance with requirements of Contract Documents.
- E. Fit Work tight to adjacent elements. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- F. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material to full thickness of penetrated element.
- H. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

#### 1.14 SUBMITTAL PROCEDURES

- A. All data should be submitted as a single package. Engineer will commence review only when all data has been received.
- B. Identify Project, Contractor, sub-contractor, supplier, and pertinent drawing and detail number, and specification section number, appropriate to submittal.
- C. Apply Contractor's stamp, signed or initialed, certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and contract documents.

- D. The Contractor shall determine and verify field measurements and field construction criteria for conformance with drawings and specifications and for conflicts with other items of construction, past or present. He shall coordinate each submittal with the requirements of the work and of the contract documents and notify the Architect/Engineer in writing, at the time of the submission, of any and all deviations in the submittals from requirements of the work and contract documents.

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

- E. Identify variations for contract documents and product or system limitations, which may be detrimental to successful performance of the completed work.
- F. Engineer's review does not constitute acceptance or responsibility for accuracy or dimensions, nor shall it relieve the Contractor from meeting any requirements of the work and contract documents, nor shall it constitute approval for any deviation from the contract documents, unless such deviations are specifically stated as such on the submittal and specifically allowed by the Architect/Engineer by specific written notification for each such variation. The Architect/Engineer's review will not relieve the Contractor from responsibility for errors or omissions in the shop drawings.
- G. Revise and resubmit submittals as required. Identify all changes made since previous submittal.
- H. Architect/Engineer will review a submittal and, if necessary, a resubmittal of the same item. Subsequent resubmittals shall be accompanied by Contractor's purchase order to Architect/Engineer for all Architect/Engineer's review time and costs at Architect/Engineer's standard hourly billing rates. These reviews will be performed at the convenience of the Architect/Engineer.
- I. **Contractor to submit electronic submittals, one (1) hard copy must be delivered to the Engineer, hard copy will be dated when received and be the official copy.** Engineer will return submittal electronically.

#### 1.15 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedule in duplicate within 15 days after Notice to Proceed for Architect/Engineer review.
- B. Submit revised schedules with each Application for Payment, identifying changes since previous version. Indicate estimated percentage of completion for each item of Work at each submission.

#### 1.16 SHOP DRAWINGS

- A. Submit in the form of one reproducible transparency and one opaque reproduction.

#### 1.17 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit manufacturer printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

1.18 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification sections, submit certifications by manufacturer to Engineer, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.19 QUALITY CONTROL

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturer's instructions.
- C. Comply with specified standards as minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.20 TOLERANCES

- A. Monitor fabrication and installation tolerance control of installed Products over suppliers, manufacturers, Products, site conditions, and workmanship, to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply fully with manufacturer's tolerances.

1.21 REFERENCES

- A. Conform to reference standards by date of issue current as of date for receiving bids.
- B. Should specified reference standard conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

1.22 TESTING AND INSPECTION LABORATORY SERVICES

- A. Contractor will include the cost of employing an independent firm to perform testing and inspection.
- B. The independent firm will perform tests, inspections, and other services as required.
- C. Cooperate with independent firm; furnish samples as requested.
- D. Re-testing required because of non-conformance to specified requirements will be charged to the Contractor.

1.23 MANUFACTURER'S 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 and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions that are supplemental or contrary to manufacturer's written instructions.

1.24 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify that utility services are available, of the correct characteristics, and in the correct location.
- C. Contractor is solely responsible for utility location, protection and verification.

1.25 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

1.26 TEMPORARY ELECTRICITY

- A. Owner will pay cost of electricity used.
- B. Provide temporary electricity and power outlets for construction operations, connections, branch wiring, distribution boxes, and flexible power cords as required. Do not disrupt Owner's need for continuous service.

1.27 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain temporary lighting for construction operations.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Permanent building lighting may be utilized during construction.

1.28 HEATING AND COOLING

- A. Utilize Owner's existing heating and cooling plant and heat and cool as needed to maintain specified conditions for construction operations.
- B. Owner will pay cost of energy used.
- C. Maintain minimum ambient temperature of 68 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.29 VENTILATION

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Utilize existing ventilation equipment.

1.30 TELEPHONE AND FACSIMILE SERVICE

- A. Provide, maintain and pay for telephone and telephone facsimile service to field office at time of project mobilization. Allow Engineer incidental use.

1.31 SANITARY FACILITIES

- A. Provide temporary sanitary facilities in the quantity required for use by all personnel. Maintain sanitary facilities in clean and sanitary condition at all times.

1.32 FIELD OFFICES AND SHEDS

- A. Office: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

1.33 ACCESS ROADS

- A. Existing on-site roads may be used for construction traffic.

1.34 PARKING

- A. Arrange for temporary parking areas to accommodate construction personnel.

1.35 PROGRESS CLEANING AND WASTE REMOVAL

- A. Collect and maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

1.36 BARRIERS AND FENCING

- A. Provide fencing to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage.
- B. Construction: Contractor's option. Commercial grade chain link fence.
- C. Provide 8 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.37 ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.
- B. Paint surfaces exposed to view from Owner occupied areas.

1.38 PROTECTION OF EXISTING AND INSTALLED FACILITIES

- A. Contractor shall be responsible for the care and protection of the existing building and adjacent facilities and grounds on the site during progress of the work, and shall repair and make good any damage to same without additional cost to the Owner.
- B. Contractor shall protect installed Work and provide special protection where required.
- C. Prohibit traffic or storage upon waterproofed or roofed surfaces.

- B. The existing buildings contain furnishings, materials, and equipment used for various purposes. It shall be the responsibility of this Contractor to remove, store, and protect such furnishings, materials and equipment found in areas where work required in this Contract is being executed. Storage may be in adjacent areas within the building, but such furnishings, materials, and equipment shall not be moved from the building. Upon completion of work in each area the furnishings, materials, and equipment removed shall be moved back to the areas where used and restored to the original condition.

#### 1.39 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, and materials prior to Substantial Completion review.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

#### 1.40 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components specifically identified for reuse.
- B. Do not use materials and equipment removed from existing premises, except as specifically identified or allowed by the Contract Documents.

#### 1.41 DELIVERY, HANDLING, STORAGE, AND PROTECTION

- A. Deliver, handle, store, and protect Products in accordance with manufacturer's instructions.

#### 1.42 SUBSTITUTIONS

- A. Engineer will consider requests for Substitutions only at Submittal Review. Clearly identify substitutions.
- B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- C. A request constitutes a representation that the Contractor:
  - 1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product.
  - 2. Will provide the same warranty for the Substitution as for the specified Product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities.

#### 1.43 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 Architect/Engineer's inspection.

- B. Submit all closeout documents, including but not limited to:
  - 1. Copies of permits and/or inspection certificates.
  - 2. All system operation reporting, including check-out report, systems startup test reports, test and balance report.
  - 3. Operations and Maintenance Manual(s).
  - 4. Record as-built drawings.
  - 5. Spare parts
  - 6. Attendance roster for equipment training sessions, and any other specified documentation regarding training.
  - 7. Warrantee certificates.
  - 8. Any client or project specific documentation
- C. Submit final Application for Payment identifying total adjusted Contract Sum/Price, previous payments, and amount remaining due. Application for Payment will not be considered until all closeout documents have been received and final clean up accepted.

#### 1.44 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean interior and exterior surfaces exposed to view. Vacuum carpeted and soft surfaces.
- C. Clean debris from site, roofs, gutters, downspouts, and drainage systems.
- D. Replace filters of operating equipment.
- E. Remove waste and surplus materials, rubbish, and construction facilities from the site.

#### 1.45 STARTING OF SYSTEMS

- A. Provide seven days notification prior to start-up of each item.
- B. Ensure that each piece of equipment or system is ready for operation.
- C. Execute start-up under supervision of responsible persons in accordance with manufacturer's instructions.
- D. Submit a written report that equipment or system has been properly installed and is functioning correctly.

#### 1.46 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled times, at equipment location.
- D. Provide attendance roster for demonstration and training session(s).



1.47 TESTING, ADJUSTING, AND BALANCING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Contractor will include the cost of employing the services of an independent firm to perform testing, adjusting, and balancing in the Base Bid.
- C. Reports will be submitted by the independent firm to the Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.
- D. Cooperate with independent firm; furnish assistance as requested.
- E. Re-testing required because of non-conformance to specified requirements will be charged to the Contractor.

1.48 PROTECTING INSTALLED CONSTRUCTION

- A. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- B. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- C. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- D. Prohibit traffic from landscaped areas.

1.49 PROJECT RECORD DOCUMENTS

- A. The Contractor shall record into Record Drawings, Project Manual and Product Data, the actual "as-built" Work including all revisions. Record information concurrent with the construction progress legibly marked to record actual construction.
- B. Contractor shall modify original reproducible drawings and two (2) sets of the project manual, delineating recorded as-built conditions of the project or record documents compiled from the job records. The Contractor may obtain reproducible drawings from the office of the Engineer. This set of documents shall show all changes in the work, including actual location of all work.
- C. Owner requires electronic (PDF) files of "as-built" conditions. The Contractor may obtain electronic drawings from the office of the Engineer and must modify the electronic record documents. The Contractor shall submit the as-built drawings in electronic format and/or printed drawings on the medium specified. The Contractor may request Engineer to complete modifications to drawings. Such request must be accompanied by Contractor's purchase order to Engineer for drafting services.
- D. Completion of record as-built drawings is a condition of final inspection and consideration of final payment.

1.50 OPERATION AND MAINTENANCE DATA

- A. Submit 3 sets prior to final inspection, bound in 8 1/2 x 11 inch text pages, three D side ring binders with durable plastic covers.



- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.
- C. Internally subdivide the binder contents with permanent page dividers, logically organized, with tab titles clearly printed under reinforced laminated plastic tabs.
  - 1. Contents:
    - A. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, subcontractors, and major equipment suppliers.
    - B. Part 2: Operation and maintenance instructions, arranged by system.
    - C. Part 3: Project documents and certificates.

#### 1.51 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 and place in location as directed; obtain receipt prior to final payment.

#### 1.52 WARRANTIES

- A. Provide notarized copies.
- B. Execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers.
- C. Submit prior to final Application for Payment.

### **PART 2 PRODUCTS**

Not Used.

### **PART 3 EXECUTION**

Not Used.

**END OF SECTION**

## APPENDIX N

### TECHNICAL SPECIFICATIONS

<b>SECTION 23 05 00</b>	<b>BASIC MECHANICAL MAERIALS AND METHODS</b>	<b>1-5</b>
<b>SECTION 23 05 01</b>	<b>MECHANICAL DEMOLITION FOR REMODELING</b>	<b>1-2</b>
<b>SECTION 23 05 53</b>	<b>IDENTIFICATIONS FOR HVAC PIPING AND EQUIPMENT</b>	<b>1-3</b>
<b>SECTION 23 05 93</b>	<b>TESTING, ADJUSTING, AND BALANCING FOR HVAC</b>	<b>1-2</b>
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**SECTION 23 05 00**

**BASIC MECHANICAL MATERIALS AND METHODS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Mechanical Basic Requirements specifically applicable to Divisions 21, 22, and 23 in addition to the requirements of Division 1 - General Requirements and the General Conditions of the Contract.
  - 2. Electric motors.
  - 3. Mechanical Identification.
  - 4. Sleeves
  - 5. Mechanical sleeve seals.
  - 6. Altitude rating.

**1.02 RELATED SECTIONS**

- A. Work described in this section is related to other work described in Divisions 21, 22, 23, 27, and 28 and may be related to work in other Divisions concerning structure or appearances. Review and become familiar with work required in other Sections in this Division and with work required in the other Divisions. Coordinate with other subcontractor(s) to assure that all issues arising between related Sections are resolved.
- B. Bring to the attention of the Engineer prior to the cutoff date for Addenda, any and all discrepancies in related work. Submission of a bid or proposal indicates that all costs for this work and related work are included in the bid for this work or within the bid or proposal for the related work.

**1.03 SYSTEM DESCRIPTION**

- A. Provide complete and fully operational systems with facilities and services to meet requirements indicated and in accordance with applicable codes and ordinances.

**1.04 REGULATORY REQUIREMENTS**

- A. All mechanical work shall be performed in strict accordance with the New Mexico Building Codes, IBC, UPC, UMC, NFPA, National Gas Code, Model Energy Code, and all applicable provisions of the local authorities having jurisdiction. All materials and labor necessary to comply with rules, regulations, and ordinances shall be provided. Where the drawings and/or specifications indicate material or construction in excess of code requirements or visa-versa, the more stringent application shall govern.
- B. 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.

**1.05 SUBMITTALS**

- A. Submit all data as a single package, as the Engineer will commence review only when all data has been received.
- B. Submittal form to identify project, contractor, sub-contractor, supplier, and pertinent contract document references.
- C. Apply Contractor's stamp, signed or initialed, certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and contract documents.

- D. The Contractor shall determine and verify field measurements and field construction criteria for conformance with drawings and specifications and for conflicts with other items of construction, past or present. He shall coordinate each submittal with the requirements of the work and of the contract documents and notify the Engineer in writing, at the time of the submission, of any and all deviations in the submittals from requirements of the work and contract documents.
  - 1. No fabrication or work, which requires submittals, shall begin until submittals are returned with the Engineer's approval.
- E. Identify variations for contract documents and product or system limitations, which may be detrimental to successful performance of the completed work.
- F. Engineer's review does not constitute acceptance or responsibility for accuracy or dimensions, nor shall it relieve the Contractor from meeting any requirements of the work and contract documents, nor shall it constitute approval for any deviation from the contract documents, unless such deviations are specifically stated as such on the submittal and specifically allowed by the Engineer by specific written notification for each such variation. The Engineer's review will not relieve the Contractor from responsibility for errors or omissions in the shop drawings.
- G. Revise and resubmit submittals as required. Identify all changes made since previous submittal.
- H. The Engineer will review a submittal and, if necessary, a resubmittal of the same item. Subsequent resubmittals shall be accompanied by Contractor's purchase order to Engineer for Engineer's review time and costs at Engineer's standard hourly billing rates. These reviews will be performed at the convenience of the Engineer.
- I. Provide eight (8) copies of materials for submittal review. If Contractor intends to utilize electronic submittals, one (1) hard copy must still be delivered to Engineer, hard copy will be dated when received and will be the official copy. Engineer will return submittal electronically.

#### **1.06 SUBSTITUTIONS**

- A. Prior approval of materials and equipment will not be considered. Contract documents indicate specified equipment and acceptable alternatives. Any other equipment/material proposed must meet or exceed that specified. Equipment/material will be reviewed for compliance during submittal review process per Paragraph 1.5.
- B. Engineer will consider requests for substitutions only at submittal review. Clearly identify substitution.
- C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.
- D. A request for substitution constitutes a representation that the Contractor:
  - 1. Has investigated the proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other work, which may be required for the work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extensions which may, subsequently, become apparent.
  - 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities.

#### **1.07 OPERATIONS AND MAINTENANCE DATA**

- A. Submit three (3) sets prior to final inspection, in 8-1/2" x 11" text pages, bound in three (3) D-side ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.

- C. Internally sub-divide the binder contents with permanent page dividers, logically organized with tab titling clearly printed under reinforced, laminated plastic tabs.
- D. Contents:
  - 1. Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Sub-contractors, and major equipment suppliers.
  - 2. Operation and maintenance instructions arranged by system.
  - 3. Project documents and certificates.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. In accordance with the requirements of Division 1.

#### **1.09 RECORD AS-BUILT DRAWINGS**

- A. Maintain on site one set of record documents exclusively for the purpose of Record As-Built Drawings.
- B. Record into Record Drawings, Project Manual and Product Data, the actual "as-built" Work including all revisions. Include actual location of all work.
- C. Record information concurrent with the construction progress.
- D. Ensure entries are complete and accurate, enabling future references by Owner.
- E. Modify reproducible drawings and two (2) sets of the project manual, delineating recorded as-built conditions of the project or Record Documents compiled from the job records. The Contractor may obtain reproducible drawings from the office of the Architect or Engineer.
- F. Provide electronic (.DWG or .PDF) files of "as-built" conditions. Contractor may obtain electronic drawings from the office of the Architect or Engineer and must modify the electronic record documents. The Contractor shall submit the as-built drawings in electronic format and printed drawings on the medium specified. The Contractor may request Engineer to complete modifications to drawings. Such request must be accompanied by Contractor's purchase order to Engineer for drafting services.
- G. Completion of Record As-Built Drawings is a condition of final inspection and consideration of final payment.

#### **1.10 CLOSEOUT PROCEDURES**

- A. See Division 1 for additional closeout procedures.
- B. See Paragraph 3.7 for Substantial Completion and Final Inspection Requirements.

#### **1.11 FINAL INSPECTIONS**

- A. One final inspection for completion of project will be performed by the Engineer. Any and all additional inspections requested by the Contractor or required because of Contractor's failure to complete scope of work, shall be paid for by the Contractor. Costs for additional inspections shall be assessed at the Engineer's hourly rates.

### **PART 2 PRODUCTS**

#### **2.01 ELECTRIC MOTORS**

- A. Motors shall be of sufficient size for the duty to be performed and shall not exceed their full-rated load when the driven equipment is operating at specified capacity under the most severe conditions likely to be encountered.
- B. Each motor shall be of the horsepower specified and suitable for operation at the elevation of the job site as scheduled on the drawings.

- C. Motors shall conform to NEMA standards, applicable to IEEE Standards and ASA C50 Standards, and shall be suitable for direct coupling mounting or V-belt mounting in accordance with the drawings.
- D. Motors controlled by variable frequency drives/adjustable frequency drives, "VFD/AFD", shall be rated for use on "VFD/AFD" controllers.

## 2.02 MECHANICAL IDENTIFICATION

- A. Equipment Nameplates: Laminated three-layer plastic with engraved black letters on light background color.
- B. Valve Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches diameter.
- C. Piping:
  - 1. Conform to ASME A13.1.
  - 2. Minimum information indicating flow direction arrow and identification of fluid being conveyed.
  - 3. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
  - 4. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
  - 5. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

## 2.03 SLEEVES

- A. Sleeves for pipes through non-fire rated floors: 18 gage thick galvanized steel.
- B. Sleeves for pipes through non-fire rated beams, walls, footings, and potentially wet floors: steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for round ductwork: galvanized steel.
- D. Sleeves for rectangular ductwork: galvanized steel or wood.
- E. Sealant: acrylic

## 2.04 MECHANICAL SLEEVE SEALS

- A. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

## 2.05 ALTITUDE RATINGS

- A. Unless otherwise noted, all specified equipment capacities, air quantities, etc., are for the altitude of the job site, as scheduled on the drawings, and adjustments to manufacturer's ratings must be made accordingly.

## PART 3 EXECUTION

### 3.01 INSTALLATION - IDENTIFICATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Install plastic nameplates with adhesive.

- D. Install plastic tags with corrosion-resistant metal chain.
- E. Label piping at all terminal units and roof top AHU's.
- F. Record actual location of valves on Project Record Documents.

### **3.02 EXISTING SERVICES**

- A. The Contractor shall carefully examine the drawings and specifications, visit the site of the work, be fully informed as to all existing conditions, dimensions, and limitations before starting work.
- B. If existing active or non-active services, which are not shown on plans, are encountered which 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.

### **3.03 ELECTRICAL WIRING AND CONTROL EQUIPMENT**

- A. All motor starters, disconnects overload protection equipment, and low voltage control equipment and wiring specified under this Division will be the responsibility of this Contractor. Installation of line voltage components and wiring specified under this Division will be the responsibility of the electrical contractor. Purchase and installation of low voltage components and wiring specified under this Division will be this Contractor's responsibility.
- B. The mechanical contractor must coordinate with the electrical contractor on the division of responsibility pertaining to the purchase and installation 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.
- C. All electrical work performed under this Division will be in compliance with the NEC and all applicable city and state ordinances. All controllers furnished with mechanical equipment shall have overload protection on all phases.
- D. The mechanical contractor must coordinate with the electrical contractor to ensure that all required components of control work are included and fully understood. No additional costs shall accrue to the Owner as a result of lack of such coordination.

### **3.04 SUBSTANTIAL COMPLETION AND FINAL INSPECTION REQUIREMENTS**

- A. Before substantial completion can be granted, the following items must be completed and submitted to the Owner/Engineer:
  - 1. An approved Test and Balance Report.
  - 2. Operation test demonstrating proper operation of all equipment.
  - 3. Control diagrams, wiring diagrams, control sequences, and engineering data on components.
- B. Prior to the final inspection or consideration of final payment, the Contractor shall:
  - 1. Provide copies of permits, operating permits, and/or inspection certificates.
  - 2. Provide a check-out report.
- C. Provide operating and maintenance manual(s).
  - 1. Provide record as-built drawings.
  - 2. Return keys to the Owner.
  - 3. Deliver all spare parts.
  - 4. Touch up any damaged finishes.
  - 5. Provide a copy of attendance roster for equipment training sessions.
  - 6. Provide all warranty certificates and documentation.

**END OF SECTION**



**SECTION 23 05 01**  
**MECHANICAL DEMOLITION FOR REMODELING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section includes mechanical and plumbing demolition.

**1.02 RELATED SECTIONS**

- A. Work described in this section is related to other work described in Divisions 21, 22, 23, 25, 26, 27, and 28 and may be related to work in other Divisions concerning structure or appearances. Review and become familiar with work required in other Sections in this Division and with work required in the other Divisions. Coordinate with other subcontractor(s) to assure that all issues arising between related Sections are resolved.
- B. Bring to the attention of the Engineer prior to the cutoff date for Addenda any and all discrepancies in related work. Submission of a bid or proposal indicates that all costs for this work and related work are included in the bid for this work or within the bid or proposal for the related work.

**PART 2 PRODUCTS**

**2.01 MATERIALS AND EQUIPMENT**

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that field measurements and routing arrangements are as shown on Drawings.
- B. Existing project conditions indicated on Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.
- C. Beginning of demolition means installer accepts existing conditions.

**3.02 PREPARATION**

- A. Disconnect mechanical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate utility service outages with Utility Company and Owner.
- C. Provide temporary connections to maintain existing systems in service during construction.
- D. Existing HVAC System:
  - 1. Maintain existing system in service until new system is accepted.
  - 2. Disable system only to make switchovers and connections.
  - 3. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration.
  - 4. Make temporary connections to maintain service in areas adjacent to work area.

**3.03 DEMOLITION AND EXTENSION OF EXISTING PLUMBING AND MECHANICAL WORK**

- A. Maintain access to existing piping, ductwork and equipment remaining active and requiring access. Modify installation or install access panel.
- B. Clean and repair existing ductwork, piping and equipment to remain or to be reinstalled.



- C. Repair adjacent construction and finishes damaged during demolition and extension work.
- D. Controls: Remove existing controls and wiring or tubing, including abandoned wiring or tubing above accessible ceiling finishes. Install new controls wiring to replace existing controls wiring as required for new controls.
  - 1. Disconnect and remove abandoned control devices.
  - 2. Maintain continuity and access to existing devices and other installations remaining active and requiring access. Modify installation or provide access panel.
  - 3. Extend existing control installations using materials and methods as specified.

#### **3.04 CLEANING AND REPAIR**

- A. Clean and repair existing materials and equipment which remain or are to be reused.

#### **3.05 INSTALLATION**

- A. Install relocated materials and equipment under the provisions of Division 1.

**END OF SECTION**

**SECTION 23 05 53**  
**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.
- E. Ceiling tacks.

**1.02 REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007 (ANSI/ASME A13.1).
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.

**1.03 SUBMITTALS**

- A. See Section 23 05 00 - Basic Mechanical Materials and Methods, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.
- G. Maintain one copy of each document on site.

**PART 2 PRODUCTS**

**2.01 IDENTIFICATION APPLICATIONS**

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Tags.
- C. Automatic Controls: Tags. Key to control schematic.
- D. Control Panels: Nameplates.
- E. Dampers: Ceiling tacks, where located above lay-in ceiling.
- F. Instrumentation: Tags.
- G. Major Control Components: Nameplates.
- H. Piping: Stencilled painting.
- I. Relays: Tags.
- J. Thermostats: Nameplates.
- K. Valves: Tags and ceiling tacks where located above lay-in ceiling.

## 2.02 NAMEPLATES

- A. Equipment Nameplates: Laminated three-layer plastic with engraved black letters on light background color.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/4 inch.
  - 3. Background Color: Black.
  - 4. Plastic: Conform to ASTM D709.

## 2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

## 2.04 STENCILS

- A. Stencil Paint: As specified in Section 09 91 23, semi-gloss enamel, colors conforming to ASME A13.1.

## 2.05 PIPE MARKERS

- A. Color: Conform to ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- E. Color code as follows:
  - 1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
  - 2. Toxic and Corrosive Fluids: Orange with black letters.
  - 3. Compressed Air: Blue with white letters.

## 2.06 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
  - 1. HVAC Equipment: Yellow.
  - 2. Fire Dampers and Smoke Dampers: Red.
  - 3. Heating/Cooling Valves: Blue.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

### 3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 09 91 23.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Use tags on piping 3/4 inch diameter and smaller.
  - 1. Identify service, flow direction, and pressure.
  - 2. Install in clear view and align with axis of piping.
  - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

**END OF SECTION**

**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

**1.02 REFERENCE STANDARDS**

- A. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..
- B. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems; National Environmental Balancing Bureau.
- C. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
  - 1. Include at least the following in the plan:
    - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    - d. Final test report forms to be used.
    - e. Detailed step-by-step procedures for TAB work for each system and issue, including:
      - 1) Terminal flow calibration (for each terminal type).
      - 2) Diffuser proportioning.
      - 3) Branch/submain proportioning.
      - 4) Total flow calculations.
      - 5) Rechecking.
      - 6) Diversity issues.
    - f. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
  - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
  - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  - 5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 GENERAL REQUIREMENTS**

- A. Perform total system balance in accordance with one of the following:
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
  - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

**3.02 AIR SYSTEM PROCEDURE**

**END OF SECTION**

**SECTION 23 09 13**  
**INSTRUMENTATION AND CONTROL DEVICES FOR HVAC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Air supply system.
- B. Thermostats.
- C. Humidistats.
- D. Damper operators.

**1.02 RELATED REQUIREMENTS**

- A. Section 23 05 00 - Basic Mechanical Materials and Methods.
- B. Section 23 09 23 - Direct-Digital Control System for HVAC.
- C. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.
- D. Section 26 27 26 - Wiring Devices: Elevation of exposed components.

**1.03 REFERENCE STANDARDS**

- A. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; National Electrical Manufacturers Association.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 23 05 00 - Basic Mechanical Materials and Methods, for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 23 05 00 - Basic Mechanical Materials and Methods, for additional provisions.
  - 2. Extra Thermostats and Other Exposed Sensors: One of each type.
- G. Maintain one copy of each document on site.

**1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed at the State in which the Project is located.

- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section documented experience approved by manufacturer.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

## **1.07 WARRANTY**

- A. See Section 23 05 00 - Basic Mechanical Materials and Methods, for additional warranty requirements.
- B. Correct defective Work within a 1 year period after Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 EQUIPMENT - GENERAL**

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

### **2.02 DAMPER OPERATORS**

- A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
  - 1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
- B. Electric Operators:
  - 1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch, minimum position potentiometer, and and 24 V dc, 24 va transformer.

### **2.03 INPUT/OUTPUT SENSORS**

- A. Temperature Sensors:
  - 1. Manufacturers:
    - a. ACI, Inc. Thermistors. [www.workaci.com](http://www.workaci.com)
    - b. I-Vu Space Sensors.
  - 2. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
  - 3. Temperature sensing device must be compatible with project DDC controllers.
  - 4. Performance Characteristics:
    - a. RTD:
      - 1) Room Sensor Accuracy: Plus/minus 0.35 excluding Humidity degrees F minimum.
    - b. Thermistor:
      - 1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
      - 2) Heat Dissipation Constant: 3 mW/ per degree C.
    - c. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
    - d. Ceiling and Recessed Mount Temperature Sensors: Ceiling-mounted sensor in a low-profile housing.
    - e. Room Temperature Sensors with Integral Digital Display:
      - 1) Construct for surface.
      - 2) Provide a four button keypad with the following capabilities:



- (a) Setpoint adjustment to accommodate room setpoint.
- (b) Manual occupancy override and indication of occupancy status.

## 2.04 THERMOSTATS

- A. Electric Room Thermostats:
  - 1. Manufacturers:
    - a. i-Vu ZS Plus. [www.carrier.com](http://www.carrier.com)
    - b. or Equal Performance.
  - 2. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
  - 3. Service: Cooling and heating.
- B. Outdoor Reset Thermostat:
  - 1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
- C. Airstream Thermostats:
  - 1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
  - 2. Averaging service remote bulb element: 7.5 feet.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- F. Ensure installation of components is complementary to installation of similar components.
- G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches. Refer to Section 26 27 26.
- C. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- D. Provide guards on thermostats in entrances and public areas.
- E. Provide conduit and electrical wiring in accordance with Section 26 27 17. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

### **3.03 MAINTENANCE**

- A. Provide service and maintenance of control system for TWO years from Date of Substantial Completion.
- B. Provide complete service of controls systems, including call backs, and submit written report of each service call.
- C. In addition to normal service calls, make minimum of 4 complete normal inspections of approximately 4 hours duration to inspect, calibrate, and adjust controls.

**END OF SECTION**

**SECTION 23 09 23**  
**DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. System description.
- B. Operator interface.
- C. Controllers.
- D. System software.
- E. Controller software.
- F. HVAC control programs.

**1.02 REFERENCE STANDARDS**

- A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

**1.04 SUBMITTALS**

- A. See Section 23 05 00 - Basic Mechanical Materials and Methods, for submittal procedures.
- B. Product Data: Provide data for each system component and software module.
- C. Shop Drawings:
  - 1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
  - 2. List connected data points, including connected control unit and input device.
  - 3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.
  - 4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
  - 5. Indicate description and sequence of operation of operating, user, and application software.
- D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.
- E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
  - 1. Revise shop drawings to reflect actual installation and operating sequences.
  - 2. Include submittals data in final "Record Documents" form.
- F. Operation and Maintenance Data:
  - 1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
  - 2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
  - 3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- H. Maintain one copy of each document on site.

**1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with NFPA 70.
- B. Design system software under direct supervision of a Professional Engineer experienced in design of this Work and licensed at the State in which the Project is located.

- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of documented experience and approved by manufacturer.
- E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

#### **1.06 WARRANTY**

- A. See Section 23 05 00 - Basic Mechanical Materials and Methods, for additional warranty requirements.
- B. Correct defective Work within a 1 year period after Substantial Completion.
- C. Provide five year manufacturer's warranty for field programmable micro-processor based units.
- D. See Section 23 05 00 - Basic Mechanical Materials and Methods, for additional provisions.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Carrier Controls, Inc.; i-Vu: [www.carrier.com](http://www.carrier.com).
- B. Johnson Controls, Inc.: [www.johnsoncontrols.com](http://www.johnsoncontrols.com).
- C. Or approved substitution.

#### **2.02 SYSTEM DESCRIPTION**

- A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.
- B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
- C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 09 13.
- E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
- F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

#### **2.03 OPERATOR INTERFACE**

- A. PC Based Work Station:
  - 1. Resides on high speed network with building controllers.
  - 2. Connected to server for full access to all system information.
- B. Workstation, controllers, and control backbone to communicate using i-Vu Open Link with BACnet controllers protocol and addressing.
- C. BACnet protocol to comply with ASHRAE Std 135.
- D. Hardware:
  - 1. Desktop: 64 bit Windows 10 Pro.
    - a. Computer(s) and display(s) to be provided by DDC controls manufacturer.
    - b. Quantity: Provide allowance for one (1) computer with wireless keyboard and mouse.
    - c. Minimum RAM: DDR4, 64 GB.
    - d. Minimum Processor: Min. 6<sup>th</sup> generation Intel i7-6700K processor.
    - e. Minimum Hard Drive Memory: 512GB Solid State Drive.
    - f. Monitor: 4GB graphics memory, 27 inch monitor.
    - g. External hard drive: 1TB, USB 3.0
    - g. Location(s): As directed by the Owner.
    - h. Network Connection:
      - 1) Ethernet interface card.
      - 2) Minimum Speed: 1 Gigabit.

**2.04 CONTROLLERS****A. BUILDING CONTROLLERS**

1. General:
  - a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
  - b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
  - c. Share data between networked controllers.
  - d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
  - e. Utilize real-time clock for scheduling.
  - f. Continuously check processor status and memory circuits for abnormal operation.
  - g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
  - h. Communication with other network devices to be based on assigned protocol.
2. Communication:
  - a. Controller to reside on a BACnet network using BACnet IP, Modbus TCP/IP protocol.
  - b. Perform routing when connected to a network of custom application and application specific controllers.
  - c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
  - a. Outdoors and/or in Wet Ambient Conditions:
    - 1) Mount within waterproof enclosures.
    - 2) Rated for operation at 40 to 150 degrees F.
  - b. Conditioned Space:
    - 1) Mount within dustproof enclosures.
    - 2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
  - a. Diagnostic LEDs for power, communication, and processor.
  - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

**B. APPLICATION SPECIFIC CONTROLLERS**

1. General:
  - a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
  - b. Customized for operation within the confines of equipment served.
  - c. Communication with other network devices to be based on assigned protocol.
2. Communication:
  - a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
  - b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
  - a. Outdoors and/or in Wet Ambient Conditions:
    - 1) Mount within waterproof enclosures.
    - 2) Rated for operation at 40 to 150 degrees F.
  - b. Conditioned Space:
    - 1) Mount within dustproof enclosures.
    - 2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
  - a. Diagnostic LEDs for power, communication, and processor.
  - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Power and Noise Immunity:
  - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
  - b. Perform orderly shutdown below 80 percent of nominal voltage.
  - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

## 2.05 CONTROLLER SOFTWARE

- A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.
- B. System Security:
  1. User access secured via user passwords and user names.
  2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
  3. User Log On/Log Off attempts are recorded.
  4. Automatic Log Off occurs following the last keystroke after a user defined delay time.
- C. Object or Object Group Scheduling:
  1. Weekly Schedules Based on Separate, Daily Schedules:
    - a. Include start, stop, optimal stop, and night economizer.
    - b. 10 events maximum per schedule.
    - c. Start/stop times adjustable for each group object.
  2. Holiday or Special Schedules:
    - a. Capability to define up to 99 schedules.
    - b. Repeated annually.
    - c. Length of each period is operator defined.
- D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.
- E. Alarms:
  1. Binary object is set to alarm based on the operator specified state.
  2. Analog object to have high/low alarm limits.
  3. All alarming is capable of being automatically and manually disabled.
  4. Alarm Reporting:
    - a. Operator determines action to be taken for alarm event.
    - b. Alarms to be routed to appropriate workstation.
    - c. Reporting Options:
      - 1) Logged.
      - 2) Graphical displays.
      - 3) Dial out to Phone using i-Vu app via system protocol.
- F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.
- G. PID Control Characteristics:
  1. Direct or reverse action.
  2. Anti-windup.
  3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
  4. User selectable controlled variable, set-point, and PED gains.
- H. Staggered Start Application:
  1. Prevents all controlled equipment from simultaneously restarting after power outage.
  2. Order of equipment startup is user selectable.
- I. Anti-Short Cycling:
  1. All binary output objects protected from short-cycling.
  2. Allows minimum on-time and off-time to be selected.
- J. On-Off Control with Differential:
  1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
  2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.
- K. Run-Time Totalization:
  1. Totalize run-times for all binary input objects.
  2. Provides operator with capability to assign high run-time alarm.

**2.06 HVAC CONTROL PROGRAMS**

- A. General:
  - 1. Support Inch-pounds and SI (metric) units of measurement.
  - 2. Identify each HVAC Control system.
- B. Optimal Run Time:
  - 1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
  - 2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
  - 3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
  - 4. Use outside air temperature to determine early shut down with ventilation override.
- C. Supply Air Reset:
  - 1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multi zone systems, single zone unit discharge temperatures.
  - 2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
    - a. Raising cooling temperatures to highest possible value.
    - b. Reducing heating temperatures to lowest possible level.

**PART 3 EXECUTION****3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

**3.02 INSTALLATION**

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.

**3.03 MANUFACTURER'S FIELD SERVICES**

- A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
- B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 5 day period.
- C. Provide basic operator training for 4 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 408 hours dedicated instructor time. Provide training on site.

**3.04 DEMONSTRATION AND INSTRUCTIONS**

- A. Demonstrate complete and operating system to Owner.

**3.05 MAINTENANCE**

- A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.
- B. Provide four complete inspections per yearNone - N/A, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.
- C. Provide complete service of systems, including call backs. Make minimum of 4 complete normal inspections of approximately 6 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

**END OF SECTION**



## SECTION 23 09 93 SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.
- B. Sequence of operation for:
  - 1. Air terminal units.
  - 2. Central fan systems.

#### 1.02 SUBMITTALS

- A. See Section 23 05 00 - Basic Mechanical Materials and Methods, for submittal procedures.
- B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
  - 1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.
  - 2. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in the contract documents.
  - 3. Include at least the following sequences:
    - a. Start-up.
    - b. Warm-up mode.
    - c. Normal operating mode.
    - d. Unoccupied mode.
    - e. Shutdown.
    - f. Capacity control sequences and equipment staging.
    - g. Temperature and pressure control, such as setbacks, setups, resets, etc.
    - h. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
    - i. Effects of power or equipment failure with all standby component functions.
    - j. Sequences for all alarms and emergency shut downs.
    - k. Seasonal operational differences and recommendations.
    - l. Interactions and interlocks with other systems.
  - 4. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
  - 5. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.
- C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
  - 1. Label with settings, adjustable range of control and limits.
  - 2. Include flow diagrams for each control system, graphically depicting control logic.
  - 3. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.



4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
5. Include a key to all abbreviations.
- D. Points List: Submit list of all control points indicating at least the following for each point.
  1. Name of controlled system.
  2. Point abbreviation.
  3. Point description; such as dry bulb temperature, airflow, etc.
  4. Display unit.
  5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
  6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
  7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
  8. Calculated point (Yes / No); i.e. a "virtual" point generated from calculations of other point values.
- E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.
- F. Maintain one copy of each document on site.

### 1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing Work of this section with minimum three years documented experience.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 AIR TERMINAL UNITS

- A. Single-duct Variable Volume:
  1. Cooling with Reheat:
    - a. On a rise in space temperature above the cooling set-point, the unit modulates to its maximum airflow.
    - b. As the space temperature falls below the cooling set-point, the unit modulates to its minimum airflow.
    - c. As the space temperature continues to fall to the heating set-point, the terminal modulates to its heating minimum airflow.
- B. Fan-powered:
  1. Series Units:
    - a. Series-fan runs continuously via control interlock with the AHU supply fan.
    - b. The air valve modulates the primary airflow in response to space temperature with the reheat de-energized.
    - c. Reheat is activated to increase discharge temperature when further decrease in primary airflow will not maintain space temperature.
  2. Parallel Units:
    - a. The primary air valve delivers cooled air to the unit outlet.
    - b. Upon decrease in space temperature beyond control of the primary air valve, the fan is simultaneously energized along with the first stage of heat.
    - c. Parallel fan delivers warm plenum air from the controlled space to the unit outlet, mixing with the primary air before entering the space.

**3.02 CENTRAL FAN SYSTEMS**

- A. Time Schedule: Start and stop supply and return fans. Determine fan status by current sensing devices. If fan fails to start as commanded, signal alarm.
- B. Safety Devices:
  - 1. Freeze Protection: Stop fans and close outside air dampers if temperature before supply fan is below 37 degrees F; signal alarm.
  - 2. High Temperature Protection: Stop fans and close outside dampers if temperature in return air is above 300 degrees F; signal alarm.
  - 3. Smoke Detector: Stop fans, close outside dampers, and close smoke dampers if smoke is detected; signal alarm.
- C. Outside Air Damper: When supply fan is running, open outside air damper to minimum position. Prevent supply fan starting until outside air damper is open and position is verified.
- D. Outside, Return, and Relief Dampers:
  - 1. When supply fan is not running, outside and relief dampers are closed and return damper is open.
  - 2. When supply fan is running, dampers are controlled and operate with outside and relief dampers opening, and return damper closing.
  - 3. For cooling and outside air temperatures below 55 degrees F, modulate dampers to maintain mixed air temperature of 55 degrees F or higher.
  - 4. For cooling and outside air temperatures above 55 degrees F outside and relief dampers are open and return damper is closed.
  - 5. For cooling and outside air temperatures above 55 degrees F compare return and outside air temperatures. If return air temperature is lower, drive outside damper to minimum, close relief damper, and open return damper.
  - 6. For outside air temperatures above 79 degrees F, drive outside damper to minimum, close relief damper, and open return damper.
  - 7. For heating, drive outside damper to minimum, close relief damper, and open return damper.
- E. Display:
  - 1. System graphic.
  - 2. System on/off indication.
  - 3. System day/night mode.
  - 4. System fan on/off indication.
  - 5. Return fan on/off indication.
  - 6. Outside air temperature indication.
  - 7. Mixed air temperature indication.
  - 8. Fan discharge air temperature indication.
  - 9. Reheat zone air temperature indication.
  - 10. Fan discharge temperature control point adjustment.
  - 11. Supply static pressure indication.
  - 12. Supply static pressure control point adjustment.
  - 13. Building static pressure indication.
  - 14. Building static pressure control point adjustment.
  - 15. System on/off auto switch.
  - 16. System day/night/auto switch.
  - 17. Supply fan on/off switch.
  - 18. Return fan on/off/auto switch.

**END OF SECTION**

**SECTION 26 05 00**  
**BASIC ELECTRICAL MATERIALS AND METHODS**

**PART GENERAL**

**1.01 SUMMARY**

- A. Section includes
  - 1. Electrical Basic Requirements specifically applicable to Division 26, 27, and 28 in addition to the requirements of Division 01 - General Requirements and the General Conditions of the Contract.
  - 2. Grounding electrodes and conductors
  - 3. Bonding methods and materials
  - 4. Conduit and equipment supports
  - 5. Anchors and fasteners
  - 6. Nameplates and wire markers.

**1.02 RELATED SECTIONS**

- A. Work described in this section is related to other work described in Divisions 21, 22, 23, 26, 27, and 28 and may be related to work in other Divisions concerning structure or appearances. Review and become familiar with work required in other Sections in this Division and with work required in the other Divisions. Coordinate with other subcontractor(s) to assure that all issues arising between related Sections are resolved.
- B. Bring to the attention of the Engineer prior to the cutoff date for Addenda any and all discrepancies in related work. Submission of a bid or proposal indicates that all costs for this work and related work are included in the bid for this work or within the bid or proposal for the related work.

**1.03 SYSTEM DESCRIPTION**

- A. Grounding systems use metal frame of building and driven ground rod as grounding electrodes. Grounding system connections use mechanical fasteners.
- B. Select materials, sizes, and types of anchors, fasteners, and supports to carry loads of equipment and raceway, including weight of wire and cable in raceway. Anchor and fasten electrical products to building elements and finishes as follows:
  - 1. Concrete Structural Elements: Expansion anchors and preset inserts.
  - 2. Steel Structural Elements: Beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
  - 3. Concrete Surfaces: Self-drilling anchors and expansion anchors.
  - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Toggle bolts and hollow wall fasteners.
  - 5. Solid Masonry Walls: Expansion anchors and preset inserts.
  - 6. Sheet Metal: Sheet metal screws.
  - 7. Wood Elements: Wood screws.
- C. Identify Electrical components as follows:
  - 1. Nameplate for each electrical distribution and control equipment enclosure.
  - 2. Wire marker for each conductor at panelboard gutters, pull boxes, and outlet and junction boxes.

#### 1.04 REGULATORY REQUIREMENTS

- A. All electrical work shall be performed in strict accordance with the New Mexico Building codes, IBC, ANSI, NEC, NFPA, Model Energy Code, and all applicable provisions of the local authorities having jurisdiction. All materials and labor necessary to comply with rules, regulations, and ordinances shall be provided. Where the drawings and/or specifications indicate material or construction in excess of code requirements or visa-versa, the more stringent application shall govern.
- B. 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.

#### 1.04 SUBMITTALS

- A. Submit all data as a single package, as the Engineer will commence review only when all data has been received.
- B. Submittal form to identify project, contractor, sub-contractor, supplier, and pertinent contract document references.
- C. Apply Contractor's stamp, signed or initialed, certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and contract documents.
- D. The Contractor shall determine and verify field measurements and field construction criteria for conformance with drawings and specifications and for conflicts with other items of construction, past or present. He shall coordinate each submittal with the requirements of the work and of the contract documents and notify the Engineer in writing, at the time of the submission, of any and all deviations in the submittals from requirements of the work and contract documents.
  - 1. No fabrication or work, which requires submittals, shall begin until submittals are returned with the Engineer's approval.
- E. Identify variations for contract documents and product or system limitations, which may be detrimental to successful performance of the completed work.
- F. Engineer's review does not constitute acceptance or responsibility for accuracy or dimensions, nor shall it relieve the Contractor from meeting any requirements of the work and contract documents, nor shall it constitute approval for any deviation from the contract documents, unless such deviations are specifically stated as such on the submittal and specifically allowed by the Engineer by specific written notification for each such variation. The Engineer's review will not relieve the Contractor from responsibility for errors or omissions in the shop drawings.
- G. Revise and resubmit submittals as required. Identify all changes made since previous submittal.
- H. The Engineer will review a submittal and, if necessary, a resubmittal of the same item. Subsequent resubmittals shall be accompanied by Contractor's purchase order to Engineer for all Engineer's review time and costs at Engineer's standard hourly billing rates. These reviews will be performed at the convenience of the Engineer.
- I. See Division 01 for number of copies to be submitted.
- J. Product Data - Basic Materials and Methods: Submit manufacturer's catalog data for grounding electrodes and connections; for fastening components; and nameplates, labels, and markers.

#### **1.06 SUBSTITUTIONS**

- A. Prior approval of materials and equipment will not be considered. Contract documents indicate specified equipment and acceptable alternatives. Any other equipment/material proposed must meet or exceed that specified. Equipment/material will be reviewed for compliance during submittal review process per Paragraph 1.5.
- B. Engineer will consider requests for substitutions only at submittal review. Clearly identify substitution.
- C. Document each request with complete data, substantiating compliance of proposed substitution with contract documents.
- D. A request for substitution constitutes a representation that the Contractor:
  - 1. Has investigated the proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other work, which may be required for the work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may, subsequently, become apparent.
  - 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities.

#### **1.07 PROJECT CONDITIONS**

- A. Existing project conditions indicated on Drawings are based on casual field observation .
- B. Report discrepancies to Architect/Engineer before disturbing existing installation.

#### **1.08 COORDINATION**

- A. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other Sections to determine connection locations and requirements.
- B. Sequence rough-in of electrical connections to coordinate with installation and start-up of equipment furnished under other Sections.

#### **1.09 OPERATIONS AND MAINTENANCE MANUALS**

- A. Submit three(3)sets prior to final inspection, bound in 8-1/2" x 11" text pages, three (3) D-side ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.
- C. Internally sub-divide the binder contents with permanent page dividers, logically organized with tab titling clearly printed under reinforced, laminated plastic tabs.
- D. Contents:
  - 1. Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Sub-contractors, and major equipment suppliers.
  - 2. Operation and maintenance instructions arranged by system.
  - 3. Project documents and certificates.

### **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. In accordance with the requirements of Division 1.

### **1.11 RECORD AS-BUILT DRAWINGS**

- A. Maintain on site one set of record documents exclusively for the purpose of record as-built drawings.
- B. Record into Record Drawings, Project Manual and Product Data, the actual "as-built" Work including all revisions. Include actual location of all work.
- C. Record information concurrent with the construction progress.
- D. Ensure entries are complete and accurate, enabling future references by Owner.
- E. Modify reproducible drawings and two (2) sets of the project manual, delineating recorded as-built conditions of the project or record documents compiled from the job records. The Contractor may obtain reproducible drawings from the office of the Architect or Engineer.
- F. Provide electronic (.DWG or .PDF) files of "as-built" conditions. Contractor may obtain electronic drawings from the office of the Architect or Engineer and must modify the electronic record documents. The Contractor shall submit the as-built drawings in electronic format and printed drawings on the medium specified. The Contractor may request Engineer to complete modifications to drawings. Such request must be accompanied by Contractor's purchase order to Engineer for drafting services.
- G. Completion of record as-built drawings is a condition of final inspection and consideration of final payment.

### **1.12 CLOSEOUT PROCEDURES**

- A. See Division 1 for additional closeout procedures.
- B. See Paragraph 3.2 for Substantial Completion and Final Inspection Requirements.

### **1.13 FINAL INSPECTIONS**

- A. One final inspection for completion of project will be performed by the Engineer. Any and all additional inspections requested by the Contractor or required because of Contractor's failure to complete scope of work shall be paid for by the Contractor. Costs for additional inspections shall be assessed at the Engineer's hourly rates.

## **PART 2 PRODUCTS**

### **2.01 ROD ELECTRODES**

- A. Manufacturers:
  - 1. Thompson
  - 2. Harger
  - 3. NLP
  - 4. Or equal performance
- B. Product Description: Copper or copper-clad steel, 1/2 inch diameter rod electrode, 10 feet in length.

**2.02 NAMEPLATES**

- A. Product Description: Engraved three-layer laminated plastic nameplate, black letters on white background.
- B. Letter Size:
  - 1. 1/8 inch letters for identifying individual equipment and loads.
  - 2. 1/4 inch letters for identifying grouped equipment and loads.

**2.03 WIRE MARKERS**

- A. Product Description: Cloth tape, split sleeve, or tubing type wire markers with circuit or control wire number permanently stamped or printed.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to meet Regulatory Requirements.
- C. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- D. Provide bonding to meet Regulatory Requirements.
- E. Make electrical connections to utilization equipment in accordance with equipment manufacturer's instructions.
  - 1. Verify that wiring and outlet rough-in work is complete and that utilization equipment is ready for electrical connection, wiring, and energization.
  - 2. Make wiring connections in control panel or in wiring compartment of pre-wired equipment. Provide interconnecting wiring where indicated.
  - 3. Install and connect disconnect switches, controllers, control stations, and control devices as indicated.
  - 4. Make conduit connections to equipment, using flexible conduit. Use liquid-tight flexible conduit in damp or wet locations.
  - 5. Install pre-fabricated cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
  - 6. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- F. Install support systems sized and fastened to accommodate weight of equipment and conduit, including wiring, which they carry.
  - 1. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors.
  - 2. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
  - 3. Do not fasten supports to piping, ceiling support wires, ductwork, mechanical equipment, or conduit.
  - 4. Do not use powder-actuated anchors.
  - 5. Do not drill structural steel members.
  - 6. Fabricate supports from structural steel or formed steel members.
  - 7. Install free-standing electrical equipment on concrete pads.
  - 8. Install surface-mounted cabinets and panelboards with minimum of four (4) anchors.
  - 9. Install steel channel supports to stand cabinets 1 inch off wall in wet locations.
  - 10. Install sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.



- G. Identify electrical distribution and control equipment and loads served to meet regulatory requirements.
  - 1. Degrease and clean surfaces to receive nameplates and tape labels.
  - 2. Install nameplate parallel to equipment lines. Secure nameplate to equipment front using screws or rivets. Secure nameplate to inside face of recessed panelboard doors in finished locations.
- H. Install wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connections.
  - 1. Use branch circuit or feeder number to identify power and lighting circuits.
  - 2. Use control wire number as indicated on schematic and interconnection diagrams to identify control wiring.

### **3.02 SUBSTANTIAL COMPLETION AND FINAL INSPECTION REQUIREMENTS**

- A. Before substantial completion can be granted, the following items must be completed and/or submitted to the Owner/Engineer.
  - 1. Test, adjust, and calibrate all systems.
  - 2. Provide typed panel directories installed in each panelboard.
  - 3. Label all electrical equipment properly.
- B. Prior to the final inspection or consideration of final payment, the Contractor shall:
  - 1. Provide copies of permits and/or inspection certificates.
  - 2. Provide a check-out report.
  - 3. Provide Operation and Maintenance Manual(s).
  - 4. Provide Record As-built Drawings.
  - 5. Return keys to the Owner.
  - 6. Deliver all spare parts.
  - 7. Touch up any damaged finishes.

**END OF SECTION**



**SECTION 26 05 01**  
**MINOR ELECTRICAL DEMOLITION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electrical demolition.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 05 00 - Basic Electrical Materials and Methods.
- B. Bring to the attention of the Engineer prior to the cutoff date for Addenda any and all discrepancies in related work. Submission of a bid or proposal indicates that all costs for this work and related work are included in the bid for this work or within the bid or proposal for the related work.

**PART 2 PRODUCTS**

**2.01 MATERIALS AND EQUIPMENT**

- A. Materials and equipment for patching and extending work: As specified in individual sections.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Demolition drawings are based on casual field observation and existing record documents.
- C. Report discrepancies to Architect before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

**3.02 PREPARATION**

- A. Maintain access to existing distribution equipment remaining active and requiring access. Modify installation or provide access panel.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- C. Disable system only to make switchovers and connections. Minimize outage duration.
  - 1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
  - 2. Make temporary connections to maintain service in areas adjacent to work area.
- D. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
  - 1. Notify Owner before partially or completely disabling system.
  - 2. Notify local fire service.
  - 3. Make notifications at least 24 hours in advance.
  - 4. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
  - 1. Notify Owner at least 24 hours before partially or completely disabling system.
  - 2. Make temporary connections to maintain service in areas adjacent to work area.

### **3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

- A. Demolish and extend existing electrical work under provisions of this Division and related Divisions.
- B. Remove abandoned wiring to source of supply.
- C. Disconnect abandoned boxes and remove devices. Remove abandoned boxes if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- D. Remove abandoned enclosures and boxes.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Disconnect and remove DDC Controls, thermostats, sensors and wiring.
- H. Maintain access to existing distribution equipment remaining active and requiring access. Modify installation or provide access panel.
- I. Maintain access to existing boxes and wiring connections remaining active and requiring access. Modify installation or install access panel.

### **3.04 CLEANING AND REPAIR**

- A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

### **3.05**

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- B. Repair adjacent construction and finishes damaged during demolition and extension work.

### **3.06 INSTALLATION**

- A. Install relocated materials and equipment under the provisions of Division 1.

**END OF SECTION**