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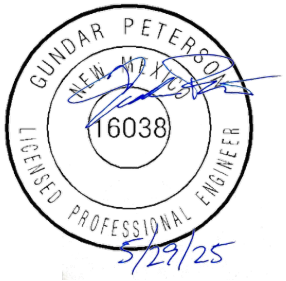


DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

SECTION 01 10 00

SUMMARY OF WORK

PART 1 GENERAL

1.1 Section Includes

A. Work description.

B. Specification conventions.

1.2 Work Description

A. The Project is for temporary and permanent water and wastewater utilities located at the Taos Regional Airport, Taos, New Mexico. The need for temporary facilities for operations and safety will be determined at the time of construction. The Project includes the following Work:
   1. Drinking water utilities:
      a. 8-inch distribution waterline serving facilities at the Airport, including all valves, and fittings.
      b. New fire hydrants
      c. Service line to yard hydrant
   2. Wastewater utilities:
      a. Duplex pump lift stations at each of the on-site facilities requiring service connections
      b. High-density polyethylene (HDPE) low pressure sewer line
      c. 2,500-gallon septic tank and duplex leach field dosing pumps
      d. Subsurface disposal field for treated effluent
      e. New security fencing around leach field and septic tank

B. All scope of work items are to be conducted according to the construction drawings and technical specifications included with these Contract Drawings and Bid Documents.

C. Perform Work of Contract under fixed cost contract with Owner in accordance with Conditions of Contract.

1.3 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 where a colon (:) is used within sentences or phrases.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 Section Includes

A. Transmittal of submittals

B. Submittal procedures

C. Definition of submittal types for construction

D. Submittals for contract closeout

E. Forms for transmittal and review

1.2 Related sections

A. Section 01 78 23 – Operation and Maintenance Data

B. Section 01 78 39 – Project Record Documents

1.3 Definitions

A. Action Submittals: Written and graphic information and physical samples that require the Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written or graphic information and physical samples that do not require the Engineer responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Close-Out Submittals: Written and graphic information and extra stock materials that require Engineer responsive action. Close-out submittals are those submittals indicated in individual Specification Sections as "close-out submittals."

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 Action Submittals

A. Submittal Schedule: Submit a schedule of submittals, per the General Conditions of the Construction Contract, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and

delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Construction Subcontractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Construction Subcontractor's construction schedule.
    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format:
    a. Use DBS&A Construction Submittal Log. The Submittal Transmittal form is provided as Attachment A.

1.5 Submittal Administrative Requirements

A. Transmittal of Submittals:
1. Provide submittals as indicated in the specific specification sections.
2. Use a DBS&A Submittal Transmittal Form to transmit submittals at the times specified in the Log.
    a. Obtain electronic version of Submittal Transmittal Form at the preconstruction conference for use during construction. The Submittal Transmittal form is provided as Attachment A.
3. Engineer Digital Data Files: Electronic digital files of the Construction Subcontract Drawings will be provided by Engineer for Construction Subcontractor's use in preparing submittals.
4. Engineer will furnish Construction Subcontractor one set of digital data drawing files of the Contract Drawings for use in preparing Submittals, Shop Drawings, Delegated Design Submittals, and Project record drawings.
    a. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD Civil 3D 2018.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule (e.g., close-out submittals). In general, submitting earlier than required is always allowed/ preferable.
3. Submit action submittals, informational submittals and sustainable design submittals required by the same Specification Section as one submittal under the same transmittal.
4. Submit close-out submittals required by the same Specification Section as separate package under separate transmittal as indicated on approved submittal schedule.

5. Submit delegated design submittals required by same Specification Section as one submittal under the same transmittal.
6. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including submittals.
1. Product data, samples, design data, test reports, qualification data and certifications: Allow 5 working days for review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Construction Subcontractor when a submittal being processed must be delayed for coordination.
2. Shop drawings, coordination drawings, sustainable design and delegated design submittals: Allow 10 working days for review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Construction Subcontractor when a submittal being processed must be delayed for coordination.
3. Close-out submittals: Allow 10 working days for review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Construction Subcontractor when a submittal being processed must be delayed for coordination.
4. Resubmittal Review: Allow 10 working days for review of each resubmittal.
5. The Construction Subcontractor shall allow a minimum of 5 working days after completion of the submittal review for return of submittals.

D. Submittal Review
1. After review of the submittal package the "Action Code" will be indicated on the submittal routing sheet and returned to the Construction Subcontractor. Review of submittals will be indicated on each Submittal Routing sheet by appropriate signature, stamp, and date.
2. Engineer will document submittal review comments on the Submittal Review Record form. Retain submittal review comments with the submittal documents.
3. DBS&A will use the following "Action Codes" to indicate the status of submittals resulting from the review, and the action required of the Construction Subcontractor:
    a. Furnish as submitted
    b. Furnish as noted
    c. Revise and resubmit
    d. Rejected
    e. Engineer's review not required.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittals of a single Submittal Log item and Submittal Transmittal Form with links enabling navigation to each item.
2. Name file with sequential submittal number, including revision identifier (A, B, C, etc.).
3. Transmittal Form for Electronic Submittals: Use DBS&A Submittal Transmittal Form. Form shall be converted to PDF and combined with submittal PDF into a single PDF file.

F. Options: Identify options requiring selection of Engineer.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Engineer's action code.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer action code.

PART 2 PRODUCTS

2.1 Submittal Procedures

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Package submittals in as few submittals as possible, in packages corresponding to each specification/technical provision section.
2. Post electronic submittals as PDF electronic files directly to Project web site specifically established for Project.
   a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
   b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Calculations: Prepare design calculations to document analytical determinations to reflect the basis for selection of systems and components. Room numbers, equipment nomenclature, fixture numbers, zone numbers, or any other designations must be consistent with those indicated on the drawings or specifications. Calculations must be checked, reviewed, sealed when required and dated by the designer and checker, and complete in all respects.

C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before or concurrent with Samples.
   6. Submit Product Data in the following format:
      a. PDF electronic file.
      b. Five paper copies of Product Data unless otherwise indicated. Engineer will return one copy.

D. Qualification Data (QD): Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

E. Project Record Documents: Comply with requirements specified in Section 01 78 39 Project Record Documents.

F. Samples/Colors: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

G. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Construction Subcontract Documents or

standard printed data unless submittal based on Engineer's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Construction Subcontract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

H. Spare Parts and Maintenance Materials: Submit spare parts, extra materials and maintenance materials in quantities, sizes, finishes and colors as identified in each specific specification. Parts and materials to be in manufacturer's original packaging with original labeling. Identify location where parts or materials are installed within facility.

1. Description of product.
2. Test procedures and results.
3. Limitations of use.

I. Warranty: Submit written and executed documentation of warranties as specified in applicable specification sections. Refer to Section 01 78 23 Operation and Maintenance Data.

PART 3 EXECUTION

3.1 Construction Subcontractor's Review

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Construction Subcontract Documents. Note corrections and field dimensions

B. Construction Subcontractor Review: Certify that submittal has been reviewed, checked, and approved for compliance with the Construction Subcontract Documents in Section 1 of the DBS&A Submittal Transmittal form. Provide any comments on the DBS&A Submittal Transmittal form.

3.2 Engineer's Action

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will indicate action code on DBS&A Submittal Review form. Provide any comments on the DBS&A Submittal Review Record Form.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Construction Subcontract Documents may be returned by the Engineer without action.

END OF SECTION

Attachment A: Submittal Transmittal Form

DBS&A
a Geo-Logic Company

Submittal Transmittal No. _____ – _____
(Spec Section) (Series)

Project Name: Taos Regional Airport Water and Wastewater Improvements		Date reviewed:
Contractor:	DBS&A Engineering	Reviewed by:
Address:	6020 Academy Road NE, Suite 100 Albuquerque, NM 87109	Job no. DB21.1385
	Attn:	Spec section:
		Drawing/Detail no.
Attn:		1st Submittal ☐ Resubmittal ☐
Date transmitted:	Previous transmittal date:	

Item No.	No. Copies	Description	Manufacturer / Vendor	Mft/Vendor Dwg. or Data No.	Action Taken *
1					
2					
3					
4					

Remarks:

* Action codes:

A – Furnish as submitted

B – Furnish as noted

C – Revise and resubmit:
1. Not enough information for review.
2. No reproducibles submitted.
3. Copies illegible.
4. Not enough copies submitted.
5. See Comments.

D – Rejected

E – Engineer's review not required:
1. Submittal not required.
2. Supplemental information. Submittal refined for informational purposes only.
3. Information reviewed on prior submittal.
4. For information only.
5. See Comments.

Contractor:
Certify either:
☐ A. We have verified that the material or equipment contained in this signature meets all requirements, including coordination with all related work, as specified (no exceptions)
☐ B. We have verified that the material contained in this submittal meets all the requirements specified except for the deviations noted below.

No. **Deviation**
_____ _____
_____ _____
_____ _____

Certified by:

Contractor's Signature, By: Date

Engineer's Comments:

Comments:

Engineer's Signature By: Date

Distribution: Contractor ☐ File ☐ Field ☐ Owner ☐ Other ☐

DBS&A
a Geo-Logic Company

This review is only for general conformance with the design concept and the information given in the Construction Documents. Corrections or comments made on the shop drawings during this review do not relieve the contractor from compliance with the requirements of the drawings and specifications. Review of a specific item shall not include review of an assembly of which the item is a component. The Contractor is responsible for dimensions to be confirmed and correlated at the jobsite, information sequences and procedures of construction, coordination of the Work with that of all other trades, and performing all Work in a safe and satisfactory manner.

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 Section Includes

A. Quality control and control of installation.

B. Tolerances.

C. References.

D. Testing and inspection services.

E. Manufacturers' field services.

F. Examination.

G. Preparation.

1.2 Quality Control and Control of Installation

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

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

C. When manufacturers’ instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

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

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

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

1.3 Tolerances

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

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

1.4 References

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standards, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

E. Neither contractual relationships, duties, nor responsibilities of parties in Contract or those of Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 Testing and Inspection Services

A. Employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing.
   1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full-time registered Engineer and responsible officer.

B. The independent firm will perform tests, inspections, and other services specified in individual specification sections and as required by Engineer.
   1. Laboratory: Authorized to operate at Project location.
   2. Laboratory Staff: Maintain full-time specialist on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Engineer or Owner.

D. Reports will be submitted by independent firm to Architect/Engineer, Contractor, and authority having jurisdiction, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
   1. Submit final report indicating correction of Work previously reported as non-compliant.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.

1. Notify Engineer and independent firm 48 hours prior to expected time for operations requiring services.
2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Retesting or reinspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Architect/Engineer. Payment for retesting or reinspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.

H. Agency Responsibilities:
1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests required by Architect/Engineer.
7. Attend preconstruction meetings and progress meetings.

I. Agency Reports: After each test, promptly submit two copies of report to Architect/Engineer, Contractor, and authority having jurisdiction. When requested by Architect/Engineer, provide interpretation of test results. Include the following:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

J. Limits On Testing Authority:
1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume duties of Contractor.
4. Agency or laboratory has no authority to stop the Work.

1.6 Manufacturers' Field Services

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

B. Submit qualifications of observer to Engineer 20 days in advance of required observations. Observer subject to approval of Engineer.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 Examination

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 Preparation

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION

SECTION 01 42 19

REFERENCE STANDARDS

PART 1 GENERAL

1.1 Work Included

A. Abbreviations and acronyms used in Contract Documents to identify reference standards.

1.2 Quality Assurance

A. Applications: when a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents or applicable codes establish stricter standards.

B. Publication Date: the publication in effect on the date of bid, except when a different publication date is specified.

1.3 Abbreviations, Names, and Addresses of Organizations

A. Obtain copies of referenced standards direct from publication source, when needed for proper performance of Work, or when required for submittal by Contract Documents.

AA	Aluminum Association 818 Connecticut Avenue, NW Washington, DC 20006
AASHTO	American Association of State Highway and Transportation Officials 444 North Capital Street NW Washington, DC 20001
ACI	American Concrete Institute Box 19150, Redford Station Detroit, MI 48219
AI	Asphalt Institute Research Park Drive PO Box 14052 Lexington, KY 40512-4052
AISC	American Institute of Steel Construction 1221 Avenue of the Americas New York, NY 10020
AISI	American Iron and Steel Institute 1000 16th Street, NW Washington, DC 20036

ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ANST	American Society for Nondestructive Testing 1711 Arlingate Lane Columbus, OH 43228-0518
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
AWS	American Welding Society 2501 NW 7th Street Miami, FL 33125
CRSI	Concrete Reinforcing Steel Institute 180 North LaSalle Street, Suite 2110 Chicago, IL 60601
FS	Federal Specification General Services Administration Specifications and Consumer Information Distributions Section (WESIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
NEMA	National Electrical Manufacturers Association 2101 L Street, NW Washington, DC 20037
NFPA	National Fire Protection Association 470 Atlantic Avenue Boston, MA 02210
NSF	National Sanitation Foundation 789 N. Dixboro Road Ann Arbor, MI 48105
OSHA	Occupational Safety and Health Administration 200 Constitution Ave. NW Washington, DC 20210

PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60076
PCI	Prestressed Concrete Institute 20 North Wacker Drive Chicago, IL 60606
PS	Product Standard U.S. Department of Commerce Washington, DC 20203
SDI	Steel Door Institute 712 Lakewood Center North Cleveland, OH 44107
SIGMA	Sealed Insulating Glass Manufacturers Association 111 East Wacker Drive Chicago, IL 60601
SJI	Steel Joist Institute 1703 Parham Road, Suite 204 Richmond, VA 23229
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

END OF SECTION

SECTION 01 45 23

OPERATIONAL AND FUNCTIONAL TESTING

PART 1 GENERAL

1.1 Description

A. This section contains requirements for the Contractor’s performance in documenting testing work required under this contract. In addition, this section contains requirements for the Contractor's performance during installed performance testing of all mechanical, electrical, instrumentation, and piping systems, including structures for watertight construction, provided under this contract. This section supplements but does not supersede specific testing requirements found elsewhere in this project manual.

1.2 Quality Assurance

A. The Contractor is responsible for Quality Assurance. The Contractor shall have experience on at least five separate projects in managing the startup commissioning of mechanical, electrical, instrumentation, and piping systems. The quality assurance program shall include:
   1. A testing plan setting forth the sequence in which all testing work required under this project manual will be implemented.
   2. A documentation program to record the results of all equipment and system tests.
   3. An installed performance testing program for all mechanical, electrical, instrumentation, and piping systems installed under this contract.
   4. A calibration program for all instruments, meters, monitors, gauges, and thermometers installed under this contract.
   5. A calibration program for all instruments, gauges, meters, and thermometers used for determining the performance of equipment and systems installed under this contract.
   6. A testing schedule conforming to the requirements specified in Section 2.2.C.

PART 2 PRODUCTS

2.1 General

A. The Contractor shall prepare test plans and documentation plans as specified in the following paragraphs. The Owner or Engineer will not witness any test work for the purpose of acceptance until all test documentation and calibration plans and the specified system or equipment test plans have been submitted and accepted.

2.2 Documentation

A. Documentation Plans:
   1. The Contractor shall develop a records keeping system to document compliance with the requirements of this Section. Calibration documentation shall include

identification (by make, manufacturer, model, and serial number) of all test equipment, date of original calibration, subsequent calibrations, calibration method, and test laboratory.

2. Equipment and system documentation shall include date of test, equipment number or system name, nature of test, test objectives, test results, test instruments employed for the test and signature spaces for the Contractor and the Owner or Engineer's witness. A separate file shall be established for each system and item of equipment. These files shall include the following information as a minimum:
   a. Factory performance tests
   b. Field calibration tests*
   c. Field pressure tests*
   d. Field performance tests*
   e. Field operational tests*

*Each of these tests is required even though not specifically noted in detailed specification section.

B. Test Plans:

1. The Contractor shall develop test plans detailing the coordinated, sequential testing of each item of equipment and system installed under this contract. Each test plan shall be specific to the item of equipment or system to be tested. Test plans shall identify by specific equipment or tag number each device or control station to be manipulated or observed during the test procedure and the specific results to be observed or obtained. Test plans shall also be specific as to support systems required to complete the test work, temporary systems required during the test work, subcontractors' and manufacturers' representatives to be present and expected test duration. As a minimum, the test plans shall include the following features:
   a. Step-by-step proving procedure for all control and electrical circuits by imposing low voltage currents and using appropriate indicators to affirm that the circuit is properly identified and connected to the proper device.
   b. Calibration of all analysis instruments and control sensors.
   c. Performance testing of each individual item of mechanical, electrical, and instrumentation equipment. Performance tests shall be selected to duplicate the operating conditions described in the project manual.
   d. System tests designed to duplicate, as closely as possible, operating conditions described in the project manual.
2. Test plans shall contain a complete description of the procedures to be employed to achieve the desired test environment.
3. As a condition precedent to receiving progress payments in excess of 75 percent of the contract amount, or in any event, progress payments due to the Contractor eight weeks in advance of the date the Contractor wishes to begin any testing work (whichever occurs earliest in the project schedule), the Contractor shall have submitted all test plans required for the systematic field performance and operational tests for all equipment and systems installed under this contract. Once the Owner or Engineer has reviewed and taken no exception to the Contractor's test plans, the Contractor shall reproduce the plans in sufficient number for the Contractor's purposes and an additional 10 copies for delivery to the Owner or

Engineer. No test work shall begin until the Contractor has delivered the specified number of final test plans to the Owner or Engineer.

C. Testing Schedule:

1. The Contractor shall produce a testing schedule setting forth the sequence contemplated for performing the test work. The schedule shall be in bar chart form, plotted against calendar time, shall detail the equipment and systems to be tested, and shall be coordinated with the Contractor's construction schedule. The schedule shall show the contemplated start date, duration of the test and completion of each test. The test schedule shall be submitted no later than four weeks in advance of the date testing is to begin. The Owner or Engineer will not witness any testing work for the purpose of acceptance until the Contractor has submitted a schedule to which the Owner or Engineer takes no exception. The test schedule shall be updated weekly, showing actual dates of test work, indicating systems and equipment testing completed satisfactorily and meeting the requirements of this project manual.

2.3 System and Equipment Performance Tests

A. Each item of mechanical, electrical, instrumentation, and HVAC equipment installed under this contract shall be tested to demonstrate compliance with the performance requirements of this project manual. Each electrical, instrumentation, mechanical, piping, and HVAC system installed or modified under this contract shall be tested in accordance with the requirements of this project manual.

2.4 Operational Tests

A. Once all equipment and systems have been tested individually, the Contractor shall fill all systems with the intended process fluids. After filling operations have been completed, the Contractor shall operate all systems for a continuous period of not less than 48 hours, simulating actual operating conditions to the greatest extent possible. The Contractor shall install temporary connections, bulkheads and make other provisions to simulate anticipated operating conditions.

B. During the operational testing period, the Contractor shall monitor the characteristics of each machine and system and report any unusual conditions to the Owner or Engineer.

2.5 Product Data

A. Product data, to be provided in accordance with Section 01 33 00, shall be the original and three copies of all records produced during the testing program.

PART 3 EXECUTION

3.1 General

A. The Contractor shall organize teams made up of qualified representatives of equipment suppliers, subcontractors, the Contractor’s independent testing laboratory, and others, as

appropriate, to efficiently and expeditiously calibrate and test the equipment and systems installed and constructed under this contract. The objective of the testing program shall be to demonstrate to the Owner or Engineer's complete satisfaction that the structures, systems, and equipment constructed and installed under this contract meet all performance requirements and the facility is ready for the commissioning process to commence. In addition, the testing program shall produce baseline operating conditions for the Owner to use in a preventive maintenance program.

3.2 Calibration of Fixed Instruments

A. Calibration of analysis instruments, sensors, gages, and meters installed under this contract shall proceed on a system-by-system basis. No equipment or system performance acceptance tests shall be performed until instruments, gauges, and meters to be installed in that particular system have been calibrated and the calibration work has been witnessed by the Owner or Engineer.

B. All analysis instruments, sensors, gages, and meters used for performance testing shall be subject to recalibration to confirm accuracy after completion, but prior to acceptance of each performance test.

3.3 Performance Tests

A. General: Performance tests shall consist of the following:
1. Pressure and/or leakage tests.
2. Electrical testing as specified.
3. Wiring and piping, individual component, loop, loop commissioning and tuning testing as described.
4. Preoperational checkout for all mechanical and HVAC equipment. Preoperational check-out procedures shall be reviewed and approved by the respective equipment manufacturers.
5. Initial operation tests of all mechanical, electrical, HVAC, and instrumentation equipment and systems to demonstrate compliance with the performance requirements of this project manual.

B. In general, performance tests for any individual system shall be performed in the order listed above. The order may be altered only on the specific written authorization of the Owner or Engineer after receipt of a written request, complete with justification of the need for the change in sequence.

C. Pressure and Leakage Tests: Pressure and leakage tests shall be conducted in accordance with applicable portions of Divisions 3 and 33. All acceptance tests shall be witnessed by the Owner or Engineer. Evidence of successful completion of the pressure and leakage tests shall be the Owner or Engineer's signature on the test forms prepared by the Contractor.

D. Functional Checkout: Prior to energization (in the case of electrical systems and equipment), all circuits shall be rung out and tested for continuity and shielding in accordance with the procedures required in Division 26.

E. Component Calibration and Loop Testing: Prior to energization (in the case of instrumentation system and equipment), all loops and associated instruments shall be calibrated and tested in accordance with the procedures required in Division 40.

F. Electrical Resistance: Electrical resistance testing shall be in accordance with electrical specifications.

G. Pre-operational Tests: Pre-operational tests shall include the following:
1. Alignment of equipment using reverse dial indicator method.
2. Pre-operation lubrication.
3. Tests per the manufacturers' recommendations for prestart preparation and preoperational check-out procedures.

H. Functional Tests:
1. General
a. Once all affected equipment has been subjected to the required preoperational check-out procedures and the Owner or Engineer has witnessed and has not found deficiencies in that portion of the work, individual items of equipment and systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these specifications. Potable water shall be· employed as the test medium. Test media for these systems shall either be the intended fluid or a compatible substitute. The equipment shall be operated a sufficient period of time to:
1) Determine machine operating characteristics, including noise, temperatures and vibration
2) Observe performance characteristics
3) Permit initial adjustment of operating controls
b. When testing requires the availability of auxiliary systems such as looped piping, electrical power, compressed air, control air, or instrumentation that have not yet been placed in service, the Contractor shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system at no additional cost to the Owner. Disposal methods for test media shall be subject to review by the Owner or Engineer. During the functional test period, the Contractor shall obtain baseline operating data on all equipment with motors greater than 1 horsepower to include amperage, bearing temperatures, and vibration. The baseline data shall be collected for the Owner to enter in a preventive maintenance system.
c. Test results shall be within the tolerances set forth in the detailed specification sections of this project manual. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory functional test, any doubt, dispute, or difference should arise between the Owner or Engineer and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then the Owner or Engineer may order the test to be repeated. If the repeat test, using such modified methods or equipment as the Owner or

Engineer may require, confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner. Otherwise, the costs shall be borne by the Contractor. Where the results of any functional test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve the contract requirements shall be made by the Contractor at his expense.

d. The Contractor shall provide, at no expense to the Owner, all power, fuel, compressed air supplies, water, and chemicals, all labor, temporary piping, heating, ventilating, and air conditioning for any areas where permanent facilities are not complete and operable at the time of functional tests, and all other items and work required to complete the functional tests. Temporary facilities shall be maintained until permanent systems are in service.

2. Retesting:

a. If under test, any portion of the work should fail to fulfill the contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion when so adjusted, altered, removed, or replaced, together with all other portions of the work as are affected thereby, shall, unless otherwise directed by the Owner or Engineer, be repeated within reasonable time and in accordance with the specified conditions. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner, including the costs of the Owner or Engineer, as a result of repeating such tests.

3. Post-Test Inspection:

a. Once functional testing has been completed, all machines shall be rechecked for proper alignment and realigned, as required. All equipment shall be checked for loose connections, unusual movement, or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Owner or Engineer. All machines or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. Any defects found during the course of the inspection shall be repaired or the specific part or entire equipment item shall be replaced to the complete satisfaction of the Owner or Engineer at no cost to the Owner.

3.4 Operational Tests

A. The Contractor shall provide system operation testing. After completion of all performance testing and certification by the Owner or Engineer that all equipment complies with the requirements of the specifications, the Contractor shall fill all process units and process systems, except those employing domestic water, oil, air, or chemicals, with potable water. All oil, air, and chemical systems shall be filled with the specified fluid.

B. Upon completion of the filling operations, the Contractor shall circulate water through the completed facility for a period of not less than 4 hours, during which all parts of the system shall be operated as a complete facility at various loading conditions, as directed by the Owner or Engineer. The operational testing period shall commence after this initial period of variable operation. The operational testing period shall be 48 hours. Should the

operational testing period be halted for any reason related to the facilities constructed or the equipment furnished under this contract, or the Contractor's temporary testing systems, the operational testing program shall be repeated until the specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, and flow.

C. Record documents specified in Section 01 78 39 of facilities involved shall be accepted and ready for turnover to the Owner at the time of operational testing.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 Construction Safety and Phasing Plan

A. The Construction Safety and Phasing Plan shall be followed, and takes precedence over any section of this specification that may overlap or contradict the CSPP (Attachment A).

1.2 Section Includes

A. Temporary Utilities:
1. Temporary electricity.
2. Temporary lighting for construction purposes.
3. Temporary heating.
4. Temporary cooling.
5. Temporary ventilation.
6. Temporary water service.
7. Temporary sanitary facilities.

B. Construction Facilities:
1. Field offices and sheds.
2. Vehicular access.
3. Parking.
4. Progress cleaning and waste removal.
5. Project identification.
6. Traffic regulation.
7. Fire prevention facilities.

C. Temporary Controls:
1. Barriers.
2. Enclosures and fencing.
3. Security.
4. Water control.
5. Dust control.
6. Erosion and sediment control.
7. Pest control.
8. Pollution control.
9. Rodent control.

D. Removal of utilities, facilities, and controls.

1.3 Temporary Electricity

A. There is no existing power at the work site. All power must be provided by the Contractor.

1.4 Temporary Lighting For Construction Purposes

A. Provide and maintain lighting for construction operations.

B. Maintain lighting and provide routine repairs.

1.5 Temporary Heating

A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

1.6 Temporary Cooling

A. Provide and pay for cooling devices and cooling as needed to maintain specified conditions for construction operations.

1.7 Temporary Ventilation

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.8 Temporary Water Service

A. The WWTP site has no water service available. The Contractor will provide any water necessary for construction. Provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations. Contractor to coordinate connection to an existing water source with Taos Utilities. Provide separate metering and reimburse Owner for cost of water used.

1.9 Temporary Sanitary Facilities

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.

1.10 Field Offices and Sheds

A. Do not use existing facilities for field offices or for storage.

B. Office: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture and drawing display table.

C. Storage Areas And Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01 60 00 Product Requirements.

D. Preparation: Fill and grade sites for temporary structures sloped for drainage away from buildings.

E. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

1.11 Vehicular Access

A. Construct temporary all-weather access roads from public thoroughfares to serve construction area, of width and load-bearing capacity to accommodate unimpeded traffic for construction purposes as needed with Owner/Engineer approval.

B. Construct culverts to span low areas and allow unimpeded drainage as needed.

C. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.

D. Location approved by Owner.

E. Provide unimpeded access for emergency vehicles. Maintain 20-foot-wide driveways with turning space between and around combustible materials.

F. Provide and maintain access to fire hydrants and control valves free of obstructions.

G. Provide means of removing mud from vehicle wheels before entering streets.

H. Use designated existing on-site roads for construction traffic.

1.12 Parking

A. Arrange for temporary gravel surface parking areas to accommodate construction personnel.

B. Locate as approved by Owner.

C. When site space is not adequate, provide additional off-site parking.

D. Use of designated existing on-site streets and driveways used for construction traffic is permitted. Tracked vehicles not allowed on paved areas.

E. Use of existing parking facilities used by construction personnel is not permitted.

F. Do not allow heavy vehicles or construction equipment in parking areas.

G. Do not allow vehicle parking on existing pavement.

H. Maintenance:
1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
2. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies to maintain paving and drainage in original, or specified, condition.

I. Mud from Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.13 Progress Cleaning and Waste Removal

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

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose of off-site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 Project Identification

A. Project signage shall meet the requirements in attachment 1 to this specification.

1.15 Traffic Regulation

A. Signs, Signals, And Devices:
   1. Post-Mounted and Wall-Mounted Traffic Control and Informational Signs: As approved by authority having jurisdiction.
   2. Automatic Traffic Control Signals: As approved by local jurisdictions.
   3. Traffic Cones and Drums, Flares and Lights: As approved by authority having jurisdiction.
   4. Flagperson Equipment: As required by authority having jurisdiction.

B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

C. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

D. Haul Routes:
   1. Consult with authority having jurisdiction, and establish public thoroughfares to be used for haul routes and site access.

E. Traffic Signs and Signals:
   1. Provide signs at approaches to site and on site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
   2. Relocate as Work progresses to maintain effective traffic control.

F. Removal:
   1. Remove equipment and devices when no longer required.
   2. Repair damage caused by installation.
   3. Remove post settings to depth of 2 feet.

1.16 Fire Prevention Facilities

A. Establish fire watch for cutting and welding and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.

B. Portable Fire Extinguishers: NFPA 10; 10-pound capacity, 4A-60B: C UL rating.
1. Provide minimum one fire extinguisher in every construction trailer and storage shed.

1.17 Barriers

A. Provide barriers to prevent unauthorized entry to construction areas, and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide protection for plants designated to remain. Replace damaged plants.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.18 Enclosures and Fencing

A. Provide 6 feet high fence around construction site; equip with vehicular and pedestrian gates with locks where existing fence is removed or as necessary to enclose staged equipment or material.

1.19 Security

A. Security Program:
1. Protect Work and Owner's operations from theft, vandalism, and unauthorized entry.
2. Maintain program throughout construction period until Owner acceptance precludes need for Contractor security.

B. Entry Control:
1. Restrict entrance of persons and vehicles into Project site and existing facilities.
2. Coordinate access of Owner's personnel to site in coordination with Owner’s security forces.

1.20 Water Control

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.21 Dust Control

A. Execute Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent airborne dust from dispersing into atmosphere.

1.22 Erosion and Sediment Control

A. Plan and execute construction by methods to control surface drainage from cuts and fills from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow off site.

C. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

D. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.23 Pollution Control

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations.

B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.24 Removal of Utilities, Facilities, and Controls

A. Remove temporary utilities, equipment, facilities, and materials prior to Final Application for Payment inspection.

B. Remove underground installations to minimum depth of 2 feet. Grade site as indicated on Drawings.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

OMB Number: 0610-0096
Expiration Date: 01/31/2025

EDA PROJECT SIGN

The Contractor shall supply, erect, and maintain in good condition a project sign according to the specifications set forth below:

EDA SITE SIGN SPECIFICATIONS

Size: 4' x 8' x ¾"

Materials: Exterior grade/MDO plywood (APA rating A-B)

Supports: 4" x 4" x 12' posts with 2" x 4" cross branching

Erection: Posts shall be set a minimum of three feet deep in concrete footings that are at least 12" in diameter.

Paint: Outdoor enamel

Colors: Jet Black, Blue (PMS300), and Gold (PMS7406). Specifically, on white background the following will be placed:

The U. S. Department of Commerce seal in blue, black, and gold;

"EDA" in blue;

"U. S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT

ADMINISTRATION" in black;

"In partnership with" in blue;

(Actual name of the) "EDA Grant Recipient" in black;

Lettering: Specific fonts are named below; positioning will be as shown on the attached illustration.

"U. S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT ADMINISTRATION" use Bank Gothic Medium - BANK GOTHIC MED

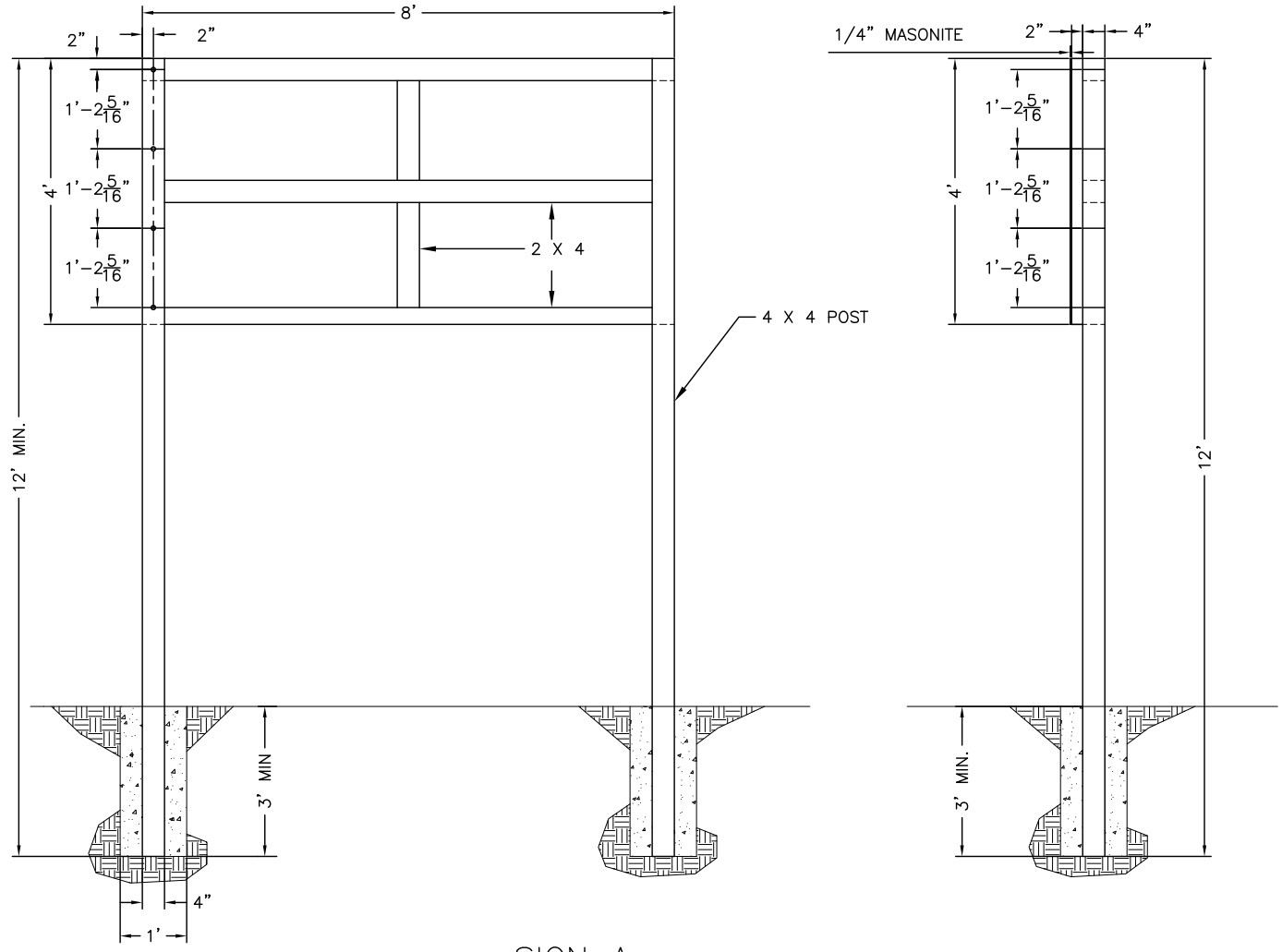
"In partnership with" use Univers™ 55 Oblique - *Univers 55*

(Name of) "EDA Grant Recipient" use Univers™ Extra Black 85 **Univers 85**

Project signs will not be erected on public highway rights-of-way. If any possibility exists for obstruction to traffic line of sight, the location and height of the sign will be coordinated with the agency responsible for highway or street safety in the area.

The EDA Regional Director may permit modifications to these specifications if they conflict with state law or local ordinances.

OMB Number: 0610-0096
Expiration Date: 01/31/2025

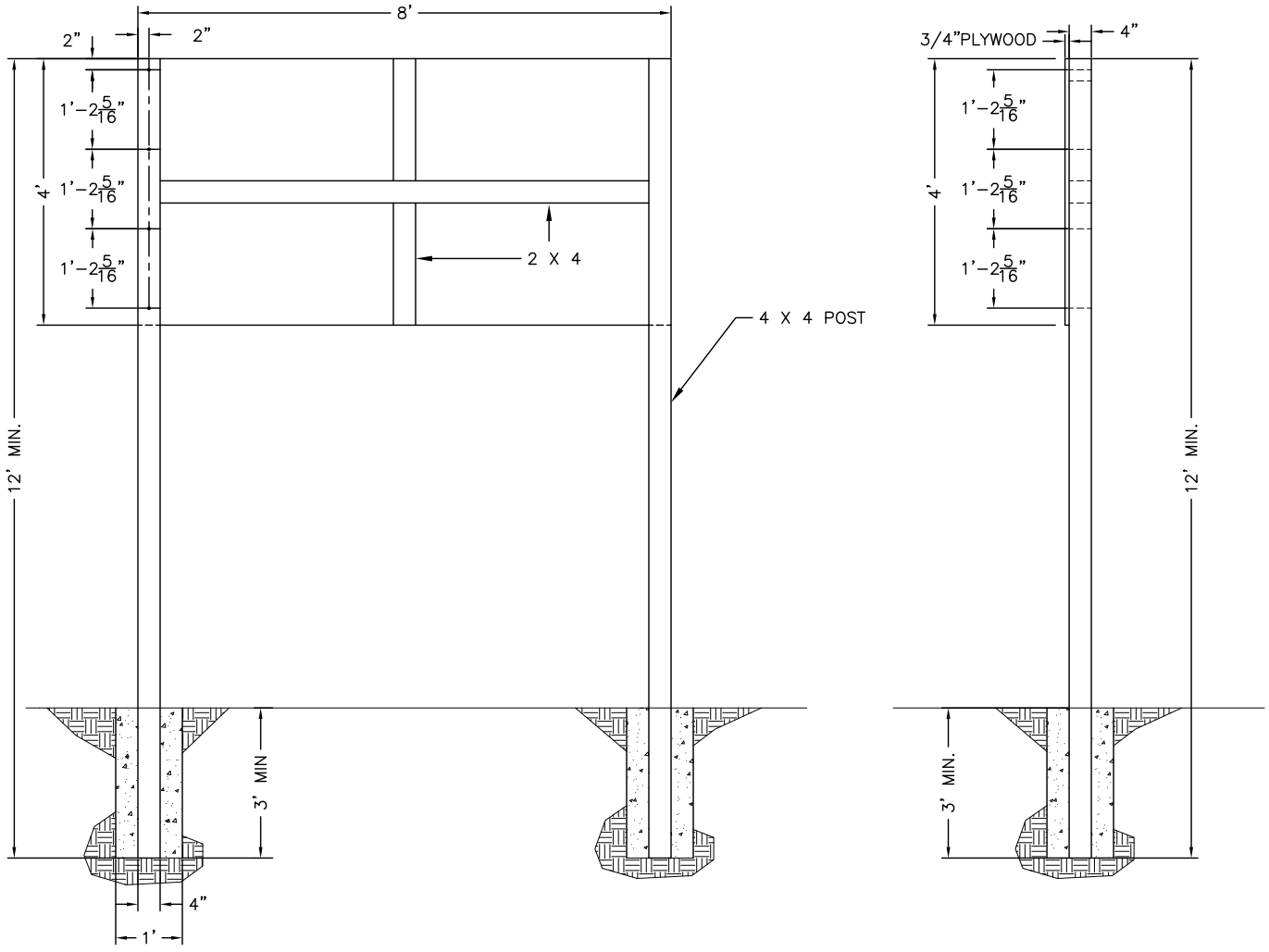


SIGN A
MASONITE SIGN

SCALE: 3/8" = 1'

PROJECT - SIGN A
ECONOMIC DEVELOPMENT ADMINISTRATION

OMB Number: 0610-0096
Expiration Date: 01/31/2025



SIGN B
PLYWOOD SIGN
SCALE: 3/8" = 1'

PROJECT - SIGN B
ECONOMIC DEVELOPMENT ADMINISTRATION

EDA

U.S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT ADMINISTRATION

In partnership with

<EDA Grant Recipient Name>

2.25”

13.5”

1.75”

1.75”

EDA

10”

Black
Blue= PMS300
Gold= PMS7406

2.0”

1.5”

U.S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT ADMINISTRATION

4.0”

48”

3.0”

In partnership with

3.0”

<EDA Grant Recipient Name>

3.75”

15.0”

96"

SECTION 01 57 23

STORMWATER POLLUTION PREVENTION PLAN

PART 1 GENERAL

1.1 Work Included

A. Prepare a Stormwater Pollution Prevention Plan (SWPPP) to provide temporary measures to control water pollution and soil erosion from all construction activities and prevent sedimentation of arroyos and rivers and the pollution of private properties from storm water, as required by the Clean Water Act (CWA) in accordance with the National Pollutant Discharge Elimination System (NPDES) Phase II Regulations. The Contractor shall maintain the SWPPP for the entire duration of the construction.

B. Temporary control may include work outside the construction limits, such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

1.2 Related Work

A. DIVISION 31 - EARTHWORK

1.3 Submittals

A. Copies of SWPPP to the Owner and Engineer.

PART 2 PRODUCTS

2.1 General

A. Materials for temporary erosion and sediment control shall conform to details shown in the drawings and the requirements of referenced specifications.

B. Materials for filter dams, check dams, sediment basins, and sediment traps shall consist of straw bale barriers or siltation fences, rock, brush, bagged sand, riprap, soil retention blankets, masonry blocks, lumber or other erosion resistant material.

C. Degradable materials furnished for temporary erosion and sediment control measures shall be of a quality and durability to remain fully effective for the purpose intended throughout the time period required.

D. Slope drain material shall consist of pipe, flexible pipe and riprap. Other materials may be used if approved by the Project Manager/Engineer.
1. Pipe: Steel pipe and appurtenances shall conform to requirements of AASHTO M 36, and corrugated polyethylene pipe, couplings and fittings shall conform to requirements of AASHTO M 252 for diameters of 3 to 10 inches and AASHTO M 294 for diameters greater than 10 inches.

2. Other types of pipe may be used when approved by the Engineer.

E. Soil retention blankets shall be PPS Super Duty, American Excelsior High Velocity, North American Green S-150 or approved equal.

F. Riprap and rock plating shall conform with requirements of New Mexico Department of Transportation (NMDOT), Standard Specifications for Road and Bridge Construction, latest edition.

PART 3 EXECUTION

3.1 General

A. Implement temporary pollution control measures to minimize soil erosion to comply with NPDES stormwater discharge permit requirements for construction activities. Provide temporary control measures as indicated in the SWPPP filed on-site.

B. Implement all applicable features of the SWPPP prior to beginning construction. Complete all temporary pollution control features at the earliest practicable time and use such measures to comply with NPDES permit terms and conditions, to correct unforeseen conditions that occur during construction or to correct conditions that are needed prior to completion of permanent soil erosion and sediment control measures.

C. Limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, or borrow and fill operations.

D. Maintain erosion control features that are installed in an acceptable manner during the construction period.

E. Provide temporary control structures whenever construction equipment must cross watercourses at frequent intervals, and such crossings will adversely affect the sediment levels.

F. Remove accumulated sediment when 50 percent of the storage volume has been used. All sediment disposal activities will be on-site.

3.2 Designated Areas

A. Project areas to be considered for SWPPP.
1. Southwest Interconnect transmission Line route.
2. Ground level steel water tank and pump house site.
3. Wastewater treatment plant site.
4. Water and sewer force main installation between all sites.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 Section Includes

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

F. Equipment electrical characteristics and components.

1.2 Products

A. Applicable Sections of the latest edition of the New Mexico Specifications for Public Works Construction shall be followed for product delivery, handling, and storage.

B. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

1.3 Product Delivery Requirements

A. Transport and handle products in accordance with manufacturer instructions and the latest edition of the New Mexico Specifications for Public Works Construction.

B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 Product Storage and Handling Requirements

A. Store and protect products in accordance with manufacturer instructions and the latest edition of the New Mexico Specifications for Public Works Construction.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather-tight, climate-controlled enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify that products are undamaged and maintained in acceptable condition.

1.5 Product Options

A. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 Product Substitution Procedures

A. Engineer will consider requests for Substitutions prior to the date for receipt of Bids. Substitution Submittal Procedure prior to the date for receipt of Bids is governed by the Bidding Documents.

B. After the date for receipt of Bids, Substitutions will only be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that Contractor:
1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
2. Will provide same warranty for Substitution as for 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 for review or redesign services associated with reapproval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals without separate written request or when acceptance will require revision to Contract Documents.

F. After the date for receipt of Bids, Substitution Submittal Procedure:

1. Submit four copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
3. Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 70 00

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 Work Included

A. Comply with requirements stated in Conditions of the Contract and Specifications for administrative procedures in closing out the Work.

1.2 Related Work

A. Section 01 78 39 Project Record Drawings

1.3 Substantial Completion

A. When Contractor considers the Work is substantially complete, the Contractor shall submit to Engineer:
   1. A written notice that the Work, or designated portion thereof, is substantially complete
   2. A list of items to be completed or corrected.

B. Within a reasonable amount of time after receipt of such notice, Engineer will make an inspection to determine the status of completion.

C. Should Engineer determine that the Work is not substantially complete:
   1. Engineer will promptly notify the Contractor in writing, giving the reasons.
   2. Contractor shall remedy the deficiencies in the Work and send a second written notice of substantial completion to the Engineer.
   3. Engineer will reinspect the Work.

D. Upon satisfactory completion of the review, the Engineer shall issue to the contractor a written “Notice of Substantial Completion.”

1.4 Final Inspection

A. When Contractor considers the Work is complete, the Contractor shall submit written certification that:
   1. Contract Documents have been reviewed.
   2. Work has been inspected for compliance with Contract Documents.
   3. Work has been completed in accordance with Contract Documents.
   4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
   5. Work is completed and ready for final inspection.

B. Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should Engineer consider that the Work is incomplete or defective:
   1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
   2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Engineer that the Work is complete.
   3. Engineer will reinspect the Work.

D. When the Engineer finds that the Work is acceptable under the Contract Documents, the Contractor shall request the Contractor to make closeout submittals.

1.5 Reinspection Fees

A. Should Engineer perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
   1. Owner will compensate Engineer for such additional services.
   2. Contractor shall submit purchase order to pay Engineer at Engineer's standard billing rate for all costs associated with reinspection.

1.6 Contractor's Closeout Submittals to Engineer

A. Evidence of compliance with requirements of governing authorities.

B. Project Record Documents: Conform to requirements of Section 01 78 39.

C. Warranties and Bonds: Conform to requirements of General Conditions.

D. Evidence of Payment and Release of Liens: Conform to requirements of General and Supplemental Conditions.

E. Consent of Surety

F. Certification of Labor Standards.

1.7 Final Adjustments of Accounts

A. Submit a final statement of accounting to Engineer.

B. Statement shall reflect all adjustments to the Contract Sum:
   1. The original Contract Sum.
   2. Additions and deductions resulting from:
      a. Previous Change Orders.
      b. Allowances.
      c. Unit Prices.
      d. Deductions from uncorrected Work.
      e. Deductions for liquidated damages.
      f. Deductions for reinspection payments.
      g. Other adjustments.
   3. Total Contract Sum, as adjusted.
   4. Previous payments.

5. Sum remaining due.

C. Engineer will prepare a final Change Order, reflecting approved adjustments to the Contract Sum not previously made by Change Orders.

D. Final Application for Payment
1. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 Work Included

A. Compile product data and related information appropriate to Contractor's installation and for Owner's maintenance and operation of products furnished under the Contract.

B. Prepare operating and maintenance data, as specified in this Section and as referenced in other pertinent sections of these Specifications.

C. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

1.2 Related Work

A. Section 01 78 39 – Project Record Documents

1.3 Quality Assurance

A. Preparation of data shall be done by personnel:
1. Trained and experienced in maintenance and operation of the described products.
2. Completely familiar with requirements of this Section.
3. Skilled as technical writers to the extent required to communicate essential data.
4. Skilled as draftsmen competent to prepare required Drawings.

B. Manuals for equipment and systems shall be prepared by the equipment manufacturer or system supplier.

1.4 Submittals

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Format:
1. Size: 8.5-inch x 11-inch.
2. Paper: 20 lb minimum, white, for typed pages.
3. Text:
   a. Manufacturer's printed data.
   b. Neatly typewritten.
4. Drawings:
   a. Provide reinforced, punched binder tab; bind in with text.
   b. Reduced to 8.5-inch x 11-inch, or 11-inch x 17-inch folded to 8.5-inch x 11-inch.
   c. Where reduction is impractical, folded and placed in 8W' x 11" envelopes bound in text.
   d. Suitably identified on Drawings and envelopes.

5. Provide fly leaf for each separate product or each piece of operating equipment.
   a. Provide typed description of product and major component parts of equipment.
   b. Provide indexed tabs.
6. Cover:
   a. Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS".
   b. List
      1) Title of Project.
      2) Identity of separate structure, as applicable.
      3) Identity of general subject matter covered in manual.
7. Assembly
   a. Assemble and bind material in the same order as specified in Paragraph 1.4
   b. Material grouped in the same manner as the applicable portions of the Contract Documents

C. Binders
1. Preliminary manuals: heavy paper covers.
2. Final manuals: commercial-quality, substantial, permanent, 3-ring or 3-post binders with durable, cleanable plastic covers of adequate size to easily contain required information.

1.5 Content of Manuals

A. Neatly typewritten table of contents for each volume, arranged in a systematic order.
1. Contractor, name of responsible principal, address and telephone number.
2. A list of each product required to be included, indexed to the content of the volume.
3. List, with each product, the name, address and telephone number of:
   a. Subcontractor or installer.
   b. Maintenance contractor, as appropriate.
   c. Identify the area of responsibility of each.
   d. Local source of supply for parts and replacement.
   e. Manufacturer.
4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:
1. Include only those sheets which are pertinent to the specific product.
2. Annotate each sheet to:
   a. Clearly identify the specific product or part installed.
   b. Clearly identify the data applicable to the installation.
   c. Delete references to inapplicable information.
3. Preventive maintenance information shall be given for each major component of every piece of equipment in the format included in this Section.

C. Drawings:
1. Supplement product data with Drawings as necessary to clearly illustrate:

a. Relations of component parts of equipment and systems.
b. Control and flow diagrams.

2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
3. Do not use Project Record Documents as maintenance drawings.

D. Written text as required to supplement product data for the particular installation:
1. Organize in a consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.

E. Copy of each warranty, bond and service contract issued:
1. Provide information sheet for Owner's personnel; give:
a. Proper procedures in the event of failure.
b. Instances which might affect the validity of warranties or bonds.

F. Provide an installation, operation and maintenance manual for each item of equipment or system listed in the schedule of manuals, in the quantity listed in the submittal schedule.

G. Content for each unit of equipment and system, as appropriate.
1. Description of unit and component parts:
a. Function, normal operating characteristics and limiting conditions.
b. Performance curves, engineering data and tests.
c. Complete nomenclature and commercial number of all replaceable parts.
2. Manufacturer's complete installation instructions and recommendations.
3. Operating procedure:
a. Startup, break-in, routine and normal operating instructions.
b. Regulation, control, stopping, shutdown and emergency instructions.
c. Summer and winter operating instructions, as applicable.
d. Special operating instructions.
4. Maintenance procedures:
a. Routine operations.
b. Guide to "trouble-shooting".
c. Disassembly, repair and reassembly.
d. Alignment, adjusting and checking.
e. Provide preventive maintenance information for each major component of every piece of equipment as required on the "Preventive Maintenance Information & Equipment Data Sheet" attached at the end of this Section.
5. Servicing and lubrication schedule:
a. List of lubricants required.
b. Provide lubrication information for each major component of every piece of equipment as required on the "Preventive Maintenance Information & Equipment Data Sheet" attached at the end of this Section.
6. Manufacturer's printed operating and maintenance instructions.
7. Description of sequence of operation.
8. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
a. Predicted life of parts subject to wear.

b. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.

9. As-installed control diagrams.
10. Other data as required under pertinent sections of Specifications.

H. Content, for each electric and electronic item or system, as appropriate:
1. Description of system and component parts:
a. Function, normal operating characteristics and limiting conditions.
b. Performance curves, engineering data and tests.
c. Complete nomenclature and commercial number of replaceable parts.
2. Circuit directories of panelboards:
a. Electrical service.
b. Controls.
c. Communications.
3. As-installed color-coded wiring diagrams.
4. Operating procedures:
a. Routine and normal operating instructions.
b. Sequences required.
c. Special operating instructions.
5. Maintenance procedures:
a. Routine operations.
b. Guide to "trouble-shooting".
c. Adjustment and checking.
6. Manufacturer's printed operating and maintenance instructions.
7. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
8. Other data as required under pertinent sections of Specifications.

I. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel, or as necessary to provide complete operation and maintenance instructions.

J. Additional requirements for operating and maintenance data: the respective sections of Specifications.

1.6 Submittal Schedule

A. Manuals for Equipment and Systems:
1. Submit four preliminary copies prior to the date of shipment of the equipment or system.
a. Engineer shall review.
b. If acceptable:
1) One copy shall be returned to the Contractor.
2) One copy sent to the Engineer's resident project representative.
3) Two copies retained in Engineer's files.
c. If unacceptable:
1) Two copies shall be returned to Contractor with Engineer's comments for revision.
2) Two copies retained in Engineer's files.

3) Resubmit four revised preliminary copies for Engineer's review.
4) Once the Engineer has determined that a manual is not acceptable, the remainder of the manual shall not be reviewed in detail.

d. No partial payments shall be made for equipment and systems, either on hand or installed, until preliminary manuals are submitted and acceptable to the Engineer.

e. Funding:
1) Agency funds may be withheld from Owner if Owner's acceptable operation and maintenance manual is not submitted as required by the agencies.
2) If funds are withheld and such is partially attributable to a delay by the Contractor in submitting the required operation and maintenance materials:
a) Owner may withhold payments from Contractor.
b) Contractor shall not terminate or suspend work.
c) No additional costs or contract time shall be claimed by Contractor if Owner withholds payments.

2. Submit five final copies no less than 30 days prior to putting the equipment or system in service.
a. Engineer shall compare with accepted preliminary manual.
b. If identical or otherwise acceptable:
1) One copy shall be returned to Contractor for project record documents.
2) One copy shall be retained by Engineer.
3) Three copies shall be held for later transmittal to Owner.
c. If not acceptable:
1) All five copies shall be returned to Contractor for revision or retained by Engineer.
2) The necessary revision data shall be requested from Contractor, at Engineer's option.
d. No portion of the Work is substantially complete until final equipment and system manuals relating to that portion of the Work are accepted by Engineer.
e. Submit five copies of any revisions found desirable during instruction of Owner's personnel, with instructions for revising copies of manual.

3. If Contractor requires additional copies of the operation and maintenance manuals for the Contractor's, subcontractor's or suppliers' use, such may be submitted and shall be returned upon review by the Engineer.

1.7 Reimbursement for Engineer's Review Costs

A. For all manual reviews beyond one review of the preliminary manual and one review of final manual:
1. Contractor shall submit purchase order to pay Engineer at Engineer's standard billing rates for all costs associated with review.
2. Engineer shall perform these unscheduled reviews in the same manner as other unscheduled work.

1.8 Instruction of Owner's Personnel

A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all scheduled products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction:
   1. Contents of manual reviewed with Owner's personnel in full detail to explain all aspects of operations and maintenance.
   2. Training of personnel:
      a. In the field, review operation and maintenance, in full detail with Owner's personnel, each scheduled system or equipment.
      b. Training assistance shall not be considered complete until after equipment is fully operational and checked out and functioning satisfactorily.
      c. If training is given before equipment is completely operational, representative shall have to repeat training after equipment is fully operational.

C. Additional requirements for specialized instruction of Owner's personnel are given in the detailed equipment specifications.

D. Scheduled seven days in advance in coordination with both the Engineer and Owner's operating personnel.

E. Instruction to be performed by a qualified, experienced, regular employee of the equipment or system manufacturer, or a full-time field service representative (not sales personnel) approved by the equipment or system manufacturer.

F. If the Engineer judges the instruction to be incomplete, inadequate or inaccurate, additional instruction shall be scheduled and provided at no additional cost to the Owner.

1.9 Videotaping of Manufacturer's Instruction

A. As scheduled, the Engineer or Owner shall videotape the equipment manufacturer's instruction to the Owner's personnel.

B. For instruction to be videotaped, persons providing the instruction shall:
   1. Provide to Engineer the following:
      a. When instruction is to be scheduled.
      b. Detailed outline of topics, materials, procedures, information, etc. to be covered during instruction.
   2. Provide instruction in easily-videotaped format and presentation.
   3. Cooperate with videotaping efforts.

1.10 Schedule

A. See attached "Preventive Maintenance Information & Equipment Data Sheet" at end of this Section.

END OF SECTION

PREVENTIVE MAINTENANCE INFORMATION
AND
EQUIPMENT DATA SHEET

1. Equipment Name:

2. Equipment Number:

3. Equipment Manufacturer:

   Address:

   Phone:

4. Equipment Supplier:

   Address:

   Phone:

5. Nameplate Data:

   Drive Unit _____ h. _____ram, _____volts, _____phase
   Motor class (drip-proof, TEFC, etc.)
   Manufacturer Model No._____ Serial No.
   Other
   Driven Unit: Flow with units
   Discharge Pressure with units
   Equipment Type
   Model No. _____ Serial No. _____
   Other

6. Method of Power Transmission (direct coupled, V-belt, etc.)

7. Maintenance Requirements (list on next sheet)
Maintenance Operation: List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable.

Frequency: List required frequency of each maintenance operation.

Lubricant (if applicable): Refer by symbol to recommended lubricant from list in Item 8.

Comments: Give other applicable comments concerning maintenance operation.

Maintenance Operation	Frequency	Lubricant	Comments*
A.			
B.			
C.			

*Comments - including any special tools required.

Use additional sheets if necessary.

8. Lubricant List (provide Mobile number in addition to any other recommended manufacturers):

Reference Symbol	Mobile	Standard Oil	Gulf	Arc	or Equal
List symbols used in Item 7 above.		List equivalent lubricants, as distributed by each manufacturer for specific use recommended.			

9. This data sheet prepared by:

Firm:

Date:

END OF SECTION

SECTION 01 89 13

SITE PREPARATION

PART 1 GENERAL

1.1 Summary

A. Section Includes:
1. Removing surface debris.
2. Removing designated paving, curbs, and sidewalks.
3. Removing designated trees, shrubs, and other plant life.
4. Removing abandoned utilities.
5. Excavating topsoil.

B. Related Sections:
1. None

1.2 Definitions

A. Clearing: Clearing is the removal from the ground surface and disposal of trees, brush, shrubs, down timber, decayed wood, other vegetation, concrete, rubbish, and debris, as well as the removal of fences, stockpiled materials, and incidental structures.

B. Grubbing: Grubbing is the removal and disposal of all stumps, buried logs, roots, matted roots, and organic materials.

1.3 Quality Assurance

A. Perform Work in accordance with applicable State of New Mexico Standard Specifications.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 Disposition of Trees and Shrubs

A. General
1. Do not cut or damage trees unless so indicated or unless written permission has been obtained from the affected property owner. Three copies of such permission shall be furnished to the Engineer before removal operations commence.

B. Trees and shrubs to be removed

1. Trees and shrubs felled within the limits of work shall have their stumps grubbed and removed to a licensed disposal site. Depressions created by such removal shall be filled with structural backfill.

3.2 Clearing and Grubbing

A. Clear all items specified herein to the limits indicated or as directed by the Engineer and stockpile cleared and grubbed material on-site. Do not start earthwork operations in areas where clearing and grubbing is not complete, except that stumps and large roots may be removed concurrent with excavation. Comply with erosion and sediment control and stormwater management measures. Super silt fence shall be installed prior to earth-moving activities.

B. Clear and grub areas to be excavated, areas to receive fill, and areas upon which structures are to be constructed, as directed by the Engineer. Remove all trees, stumps, and root mats in these areas and dispose of them off-site at no cost to the property owner. Depressions made by the removal of stumps or roots shall be filled with suitable backfill.

C. The Contractor shall clear, grub, and strip the site area to the limits of disturbance shown on the Contract Drawings. Clearing and grubbing shall not be performed more than 60 days before excavation is to begin.

END OF SECTION

SECTION 02 21 00

EXISTING UNDERGROUND UTILITIES

PART 1 GENERAL

1.1 Description

A. Underground utilities are shown on the Construction Drawings based on research and limited field investigation during design. The Engineer makes no guarantees of accuracy or completeness of underground utility locations.

B. The Contractor shall locate and pothole all utilities within the construction corridor and notify the Engineer of conflicts that are not shown on the Drawings.

C. Contractor's Health and Safety Plan shall include working near Underground Utilities.

PART 2 MATERIALS

Not used

PART 3 EXECUTION

3.1 Physical Conditions–Underground Utilities

A. Shown or Indicated
1. The information and data shown or indicated in the Contract Documents with respect to existing Underground Utilities at or contiguous to the Site is based on information and data available to the Engineer unless it is otherwise expressly provided elsewhere.
2. The Engineer shall not be responsible for the accuracy or completeness of any such information or data
a. The Contractor shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Utilities shown or indicated in the Contract Documents, for coordination of the Work with the owners of such Underground Utility during construction, protection of Underground Utility as required by owners, for the safety of site workers and public and repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price.

B. Not Shown or Indicated
1. If an Underground Utility is uncovered or revealed at or contiguous to the Site that was not shown or indicated in the Contract Documents and that the Contractor could not reasonably have been expected to be aware of, the Contractor shall, promptly after becoming aware thereof and before performing any Work affected thereby, identify the location of such Underground Utility and

give written notice thereof to the Engineer. The Engineer will promptly review the Underground Utility to determine the extent to which the Contract Documents should be modified to reflect and document the consequences of the existence of the Underground Utility, and the Contract Documents will be amended or supplemented to the extent necessary. During such time, the Contractor shall be responsible for worker and public safety and protection of such Underground Utility.

C. Utility Lines

1. The Contractor shall coordinate with New Mexico One Call (NMOC) prior to and during construction activities. NMOC shall be contacted a minimum of two working days in advance of digging. The NMOC statewide number is 1-800-321-2537.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 Work Included

A. Reinforcing steel bars, welded wire fabric, and accessories for reinforcement for cast-in-place concrete.

1.2 Related Work

A. Section 03 30 00 Cast-In-Place Concrete

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

1.3 References

A. General: The publications, manuals, standard specifications and codes listed below are a part of these specifications, the same as if fully set forth herein. If two or more of these documents are in conflict, the more restrictive shall govern except as otherwise shown on the design drawings or as given herein. Except as specifically indicated otherwise, the most recent revision or edition of each item shall be used.

B. American Society for Testing and Materials (ASTM):
1. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, including Supplementary Requirements.
2. ASTM A185 - Welded Steel Fabric for Concrete Reinforcement.

C. American Concrete Institute (ACI):
1. ACI 301-10 - Specifications for Structural Concrete for Buildings.
2. ACI 315-99 - Details and Detailing of Concrete Reinforcement.
3. ACI 318-14 - Building Code Requirements for Reinforced Concrete.

D. Concrete Reinforcing Steel Institute (CRSI)
1. Manual of Standard Practice.
a. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
b. CRSI 65 - Recommended Practice for Placing Bar Supports: Specifications and Nomenclature.

1.4 Submittals

A. Submit mill test certificates for reinforcing bars and welded wire fabric, indicating physical and chemical analysis.

B. Submit product data for all proprietary items or materials proposed for use in the project.

C. Shop Drawings. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 “Details and Detailing of Concrete

Reinforcement" and ACI 315R "Manual of Engineering and Placing Drawings for Reinforced Concrete" showing bar and "Placing Drawings for Reinforced Concrete" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

D. In accordance with Section 01300 Submittal Procedures.

PART 2 PRODUCTS

2.1 MATERIAL STANDARDS

A. Reinforcing Bars: ASTM A615, deformed, Grade 40 for beam stirrups and column ties, Grade 60 for other uses.

B. Welded Wire Fabric: ASTM A185, furnished in flat sheets or standard rolls.

PART 3 EXECUTION

3.1 DETAILING

A. Except as shown otherwise in the details on the Drawings or required by the applicable provisions of the current edition of ACI 318, reinforcement shall be detailed in accordance with ACI 315.

3.2 FABRICATION

A. Except as otherwise shown on the Drawings or specified in this section or other sections of these Specifications, fabrication of reinforcing steel shall be in accordance with the CRSI Manual of Standard Practice.

B. All reinforcing steel shall be bent cold to the required configurations.

C. Except as specifically shown otherwise on the Drawings, all reinforcing steel shall be shop fabricated.

D. Do not weld reinforcing bars without specific prior approval of the Engineer.

3.3 INSTALLATION

A. General. Verify that field conditions are acceptable and are ready for the beginning of installation of reinforcement and other embedded items. Do not begin installation until all unsatisfactory conditions have been corrected.

B. Except as otherwise shown on the Drawings or specified in this section or other sections of these Specifications, install reinforcing steel in accordance with CRSI 63.

C. Prior to placing reinforcement, remove scale, loose or flaking rust, dirt, grease, and other coatings that may prevent or impair bond. Protect reinforcement from contaminants after placement.

D. Install reinforcing steel in correct position by use of preformed bolsters, chairs and spacers. Solid concrete blocks of appropriate size may be used to position bars in concrete placed on grade. Legs of steel supports which are in contact with form work shall be stainless steel or plastic tipped.

E. Space bars properly and tie securely in position before placing concrete. Tack welding to keep reinforcing in place is not permitted. The spacings shown on the drawings for reinforcement and other embedded items are maximums. Provide and install a sufficient number of items so that the spacings shown are not exceeded. Locate the first and last items in a run of uniformly spaced items at not more than one-half the typical spacing and not more than 12 inches from the end of a structural element.

F. Locate reinforcement and other items to avoid conflict with the work of other trades. Provide additional reinforcement around openings as shown. Do not cut or remove reinforcement for any reason without the prior approval of the Engineer.

G. Continuity of Vertical Reinforcement. No splices are permitted except as shown. Provide dowels from footings to walls or columns at all vertical bars in walls or columns. Except as otherwise shown, dowels shall have standard 90 degree ACI hooks with 12-inch horizontal extensions and vertical legs of sufficient length to provide ACI Class B tension lap splices with the vertical bars.

H. Continuity of Horizontal Reinforcement.

1. Footings, walls, turned-down slab edges: Bars shall be lapped not less than 32 bar diameters or 24 inches except where larger splices lengths are shown. Except where bar lengths are given, reinforcement is to be continuous for full length or width of member less required concrete covers. Do not splice transverse footing bars. Additional reinforcement shall be provided at corners, intersections and other discontinuities as shown on the drawings.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 Summary

A. Section Includes: Cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1.2 References

A. American Concrete Institute (ACI)

B. American Society for Testing and Materials (ASTM)
1. A82 Specification for Cold-Drawn Steel Wire for Concrete Reinforcement
2. A185 Specification for Steel Welded Wire Fabric, Plain for Concrete Reinforcement
3. A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
4. C31 Practice for Making and Curing Concrete Test Specimens in the Field
5. C33 Specification for Concrete Aggregates
6. C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
7. C42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
8. C94 Specification for Ready-Mixed Concrete
9. C143 Test Method for Slump of Hydraulic Cement Concrete
10. C150 Specification for Portland Cement
11. C172 Practice for Sampling Freshly Mixed Concrete
12. C231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
13. C260 Specification for Air-Entraining Admixtures for Concrete
14. C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
15. C494 Specification for Chemical Admixtures for Concrete
16. C618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
17. C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (non-shrink)
18. C1116 Specification for Fiber-Reinforced Concrete and Shotcrete
19. D994 Specification for Preformed Expansion Joint Filler for Concrete
20. D1751 Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
21. D1752 Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

C. Concrete Reinforcing Steel Institute (CRSI)

D. PS 1 US Product Standard for Construction and Industrial Plywood

1.3 Submittals

A. General: Submit the following items.

B. Product Data: Submit product data for the following materials and items.
1. Reinforcement
2. Forming Accessories
3. Admixtures
4. Patching Compounds
5. Hardener
6. Joint Systems
7. Curing Compounds
8. Sealants

C. Shop Drawings: Submit detailed shop drawings for fabrication, bending and placement of concrete reinforcement.
1. Show bar schedules, stirrup spacing, diagrams of bent bars and arrangement of reinforcement including bar overlap.
2. Include special reinforcement required for openings through concrete structures.

D. Laboratory Test Reports: Submit concrete materials test reports and mix design reports certifying that each material or item complies with or exceeds the specified requirements.

1.4 Quality Assurance

A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated:
1. ACI 301 "Specifications for Structural Concrete for Buildings"
2. ACI 302 "Guide for Concrete Floor and Slab Construction"
3. ACI 304 "Guide for Measuring, Mixing, Transporting and Placing Concrete"
4. ACI 305 "Hot Weather Concreting"
5. ACI 306 "Cold Weather Concreting"
6. ACI 308 "Standard Practice for Curing Concrete"
7. ACI 309 "Standard Practice for Consolidation of Concrete"
8. ACI 315 "Details and Detailing of Concrete Reinforcement"
9. ACI 318 "Building Code Requirements for Reinforced Concrete"
10. ACI 347 "Recommended Practice for Concrete Formwork"
11. CRSI "Manual of Standard Practice"
12. SP-66 "ACI Detailing Manual"

B. Quality Control Testing During Construction: Owner will engage concrete testing service for quality control testing during concrete operations.
1. Notify owner at least two working days in advance of field operations requiring concrete testing, or of resumption of operations after stoppages.
2. Coordinate concrete operations with testing service to facilitate quality control testing.
3. Sample and test concrete during placement of concrete as follows:
a. Sampling Fresh Concrete: ASTM C172; except modified for slump to comply with ASTM C94.

b. Slump: ASTM C143; one test for each concrete load at point of discharge and one for each set of compressive strength test specimens.
c. Air Content: ASTM C231; pressure method; one for each set of compressive strength specimens.
d. Compression Test Specimens: ASTM C31; one set of six standard cylinders for each compressive strength test, unless otherwise directed. Accommodate testing service to store cylinders on site for the first twenty-four hours after molding.
e. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time that a set of compression test specimens is made.
f. Compressive Strength Tests: ASTM C39; one set for each 150 cubic yards (115 cubic meters) or fractions thereof, of each concrete class placed in any one day or for each 5,000 sq. ft. (465 square meters) of surface area placed; two specimens tested 7 days, three specimens tested 28 days and one specimen retained in reserve for later testing if required.

4. If the average strength of six consecutive cylinders tested at 28 days falls below the required compressive strength or if any individual strength test (average of two test cylinders) falls more than 500 psi (3.5 MPa) below the specified strength, the in-place concrete represented by the low-strength cylinders shall be tested at the Contractor's expense by one of the following methods as directed by the owner's representative.
   a. Core Drilling: ASTM C42; "Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete," and ACI 318, Section 5.6.4.
   b. Load Testing: Load tests shall be performed in accordance with ACI 318, Chapter 20, "Strength Evaluation of Existing Structures."

PART 2 PRODUCTS

2.1 Form Materials for Structural Components

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork with plywood, metal, metal framed plywood faced or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces.
   1. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Contract Drawings.
   2. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
   3. Provide forms that comply with US Product Standard PS 1 and the following:
      a. B-B High Density Overlaid Concrete Form, Class I.
      b. B-B (Concrete Form) Plywood, Class I, exterior grade or better, mill oiled and edge sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Provide forms of plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Textured Finish Concrete: Provide forms with units of face design, size, arrangement and configuration as shown on Contract Drawings, or as required to match control sample. Provide solid backing and form supports to ensure stability of textured form liners.

D. Cylindrical Columns and Supports: Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

F. Form Ties: Provide factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
1. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least l/2 inch (12.7 mm) inside concrete for steel ties and l/4 inch (6.35 mm) for wire ties.
2. Unless otherwise shown, provide form ties which will not leave holes larger than l inch (25 mm) diameter in concrete surface.

2.2 Not Used

2.3 Reinforcing Materials

A. Cold-drawn steel wire: ASTM A82.

B. Welded wire fabric: ASTM A185, welded steel wire fabric. Furnish in flat sheets, not rolls, unless rolls are acceptable to the SDR.

C. Reinforcing Bars: ASTM A615, deformed.
1. Provide Grade 40 bars No. 3 and 4 for stirrups and ties.
2. Provide Grade 60 bars No. 3 to 18, except as otherwise noted.

D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place.
1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, stone, broken block or pieces of concrete.
2. For concrete-on-grade, use supports with sand plates or horizontal runners if base material will not adequately support chair legs.
3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected, stainless steel protected, or special stainless complying with CRSI Classes, C, D, or E respectively.

E. Fibrous Reinforcement: ASTM C1116.

F. Shop fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not rebend or straighten reinforcement in manner that will injure or weaken material.

G. Unacceptable Materials: Defective reinforcement shall not be permitted in work:
1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
2. Bends or kinks not indicated on Contract Drawings or final shop drawings.
3. Bars with reduced cross section due to excessive rusting or other cause.
4. Bars bent in the field and bars bent by heating.

2.4 Concrete Materials

A. Portland Cement: ASTM C150 Types I-II and III, "Low-Alkali" cement, unless otherwise specified. Use one brand of cement throughout project unless otherwise acceptable to the SDR

B. Aggregates: ASTM C33; provide aggregates from single source for exposed concrete. Do not use sandstone aggregates.
1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay lumps or other deleterious substances. Do not use dune, bank run, or manufactured sand.
2. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter, as follows:
   a. Crushed stone, processed from natural rock or stone.
   b. Natural or crushed gravel. Do not use pit or bank run gravel.
3. Maximum Aggregate Size: Not larger than one-fifth of the most narrow dimension between side or forms, one-third of the depth of slabs, or three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars. If workability and consolidation methods indicate concrete can be placed without honeycomb or voids, limitations may be waived if approved by SDR.

C. Water: Potable, clean, fresh, free from oil, acid, organic matter or other deleterious substances.

D. Fly Ash: ASTM C618, Class F; use one brand of fly ash throughout project unless otherwise acceptable to the SDR.

E. Admixtures: All admixtures shall be specified in the mix design.
1. Air-Entraining Admixture: ASTM C260
2. Water-Reducing Admixture: ASTM C494, Type A.
3. High Range Water-Reducing Admixture (Super Plasticizer): ASTM C494, Type F or Type G.
4. Water-Reducing, Retarding Admixture: ASTM C494, Type D.
5. Chloride-containing admixtures are not permitted.

2.5 Related Materials

A. Expansion Joint Materials
1. Typical Building and Concrete Paved Roadway Joints: ASTM D994, preformed strips of a bituminous mastic composition.

2. Slabs-in-Ground, Sidewalks, and Curb and Gutter Joints: ASTM D1751, preformed expansion joint filler having relatively little extrusion and substantial recovery after release from compression.
3. Hydraulic Structure Joints: ASTM D1752, preformed expansion joint fillers as specified on the Contract Documents.

B. Non-Shrink Grout: ASTM C1107, factory pre-mixed, non-metallic grout.

C. Liquid Membrane-Forming Curing Compound: ASTM C309, Type I or I-D, Class A.

D. Chemical Hardener: Hardener shall be a colorless, aqueous solution of zinc or magnesium fluosilicate. Approved proprietary hardeners shall be delivered ready for use in the manufacturer's original containers.

E. Bonding Compound: Polyvinyl acetate, rewettable type.

2.6 Concrete Mix Design

A. General: Provide "Ready-Mixed" concrete, unless otherwise approved or specified; in accordance with ASTM C94.
1. Compressive Strength
   a. Structural Concrete: Minimum 3000 psi (20.7 MPa) compressive strength at 28 days.
   b. Site Concrete: Minimum 4000 psi (27.6 MPa) compressive strength at 28 days.
2. Select water-to-cementitious materials ratio required to produce 28-day strength corresponding to over designed mix which is supported by sufficient experience data to assure that test results will fall within limits established in specification. Unless otherwise specified, the following proportions apply:

Strength psi	Min. Cement Bag/CY	Max. W/(C+FA)* Ratio Non-Air-Entrained	Max. W/(C+FA)* Ratio Air-Entrained
3000 (20.7 MPa)	5.0	0.60	0.58
4000 (27.6 MPa)	6.0	0.52	0.47

* W/(C+FA) = Water to cementitious material, cement plus fly ash by weight.

3. Slump due to water content alone (without the addition of super plasticizer) shall be as follows:

Allowable Slump	Min-Max (inch)
Reinforced foundation walls and footings	1-3 (25-76 mm)
Unreinforced footings, caissons and substructure walls	1-3 (25-76 mm)
Reinforced slabs, beams and walls	1-4 (25-102 mm)
Building columns	2-3 (51-76 mm)
Pavements	1-2 (25-51 mm)
Sidewalls, driveways and slabs-on-ground	2-4 (51-102 mm)
Heavy mass construction	1-2 (25-51 mm)
Sidewalks, curbs and gutters	2-4 (51-102 mm)

   a. After the addition of super plasticizers, slumps may range from 3 to 11 inches (76 mm to 279 mm) provided that the concrete mix is cohesive and non-segregating, has controlled time of set and minimal bleed water.

B. Aggregate: ASTM C33:
   1. Coarse Aggregate: ASTM C33, Table 2, Grading Requirements for Coarse Aggregates.
   2. Fine Aggregate: ASTM C33, Section 5.1 Sieve Analysis, Fine Aggregate.

C. Admixtures
   1. Use water-reducing admixture or high range water-reducing admixture (super plasticizer) in all concrete.
   2. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Use air content of 3.5 to 6.5%.
   3. When air-entraining admixture is used solely for increasing workability of mix, use air content of 3 to 5%.
   4. Fly Ash: Fly ash shall be used in all concrete mixes. Class F fly ash shall be proportioned by weight of cement to provide fly ash to Portland cement ratio not less than 20%, or greater than 25% of the sum of total weight of fly ash and cement.

D. High early strength concrete shall have compressive strength at 7 days equal to that specified for ordinary concrete at 28 days.

2.7 Plant, Equipment, Machines, and Tools

A. General: Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.
   1. Provide equipment with capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified.
   2. Use of equipment shall be discontinued if it produces unsatisfactory results.
   3. SDR shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

B. Slip Form Equipment: Self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to desired cross section in one pass. Slip form paver or curb-forming machine, will be approved based on trial use on the job.

C. Soft-Cut Saw: Designed and shown to be able to cut concrete shortly after final set without causing raveling or other untoward effect upon the concrete finish. Provide diamond blade with thickness no greater than ⅛ inch (3.18 mm) to soft-cut joint of size indicated.

PART 3 EXECUTION

3.1 Form Setting for Structural Components

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure.

B. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

C. Provide for openings, keyways, chamfers, inserts and other features required in work.

D. Maintain formwork construction tolerances, unless otherwise indicated:

1. Variation from Plumb:
   a. In the lines and surfaces of columns, piers, walls, and in arrises:
      1) In any 10 feet (3 m) of length ¼ inch (6.35 mm)
      2) Maximum for the entire length 1 inch (25 mm)
   b. For exposed corner columns, control-joint grooves, and other conspicuous lines:
      1) In any 20 foot (6 m) length ¼ inch (6.35 mm)
      2) Maximum for the entire length ½ inch (12.7 mm)
2. Variation from level or from grades specified in Contract Drawings:
   a. In slab soffits, ceilings, beam soffits and in arrises, measured before removal of supporting shores:
      1) In any 10 feet (3 m) of length ¼ inch (6.35 mm)
      2) In any bay or in any 20 foot (6 m) length ⅜ inch (9.53 mm)
      3) Maximum for the entire length ¾ inch (19.1 mm)
   b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
      1) In any bay or in 20 foot (6 m) length ¼ inch (6.35 mm)
      2) Maximum for the entire length ½ inch (12.7 mm)
3. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions:
   a. In any bay ½ inch (12.7 mm)
   b. In any 20 foot (6 m) of length ½ inch (12.7 mm)
   c. Maximum for the entire length 1 inch (25 mm)
4. Variation in the sizes and location of sleeves, floor openings, and wall openings
   a. ¼ inch (6.35 mm)
5. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:
   a. Minus ¼ inch (6.35 mm)
   b. Plus ½ inch (12.7 mm)
6. Footings*:
   a. Variations in dimensions in plan:
      1) Minus ½ inch (12.7 mm)
      2) Plus 2 inches (51 mm)
   b. Misplacement or eccentricity: 2% of the footing width in direction of misplacement but not more than 2 inches (51 mm)
   c. Thickness:
      1) Decrease in specified thickness 5%
      2) Increase in specified thickness No limit
7. Variation in Steps:
   a. In a flight of stairs:
      1) Rise +⅛ inch (+3.18 mm)
      2) Tread +¼ inch (+6.35 mm)
   b. In consecutive steps:
      1) Rise +1/16 inch (+1.588 mm)
      2) Tread +⅛ inch (+3.18 mm)

* Tolerances apply to concrete dimensions only.

E. Design and fabricate formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

F. Chamfer all exposed corners and edges to produce uniform smooth lines and tight edge joints, unless otherwise indicated in the Contract Drawings.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades.
   1. Determine size and location of openings, recesses and chases from trades providing such items.
   2. Accurately place and securely support items built into forms.

3.2 Not Used

3.3 Placing Reinforcement

A. Comply with CRSI's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified. Field bending of grade 60 bars is not permitted.

B. Clean reinforcement of loose rust and mill scale, earth, ice, oil, concrete splatter from previous pours, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Install welded wire fabric of same gage in as long of lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps of adjacent widths to prevent continuous laps in either direction.

E. Provide minimum cover for reinforcement of cast-in-place concrete, unless otherwise indicated.
   1. Concrete cast against and permanently exposed to earth 3 inches (76 mm)
   2. Concrete exposed to earth or weather
      a. #6 and larger 2 inches (51 mm)
      b. #5 and smaller 1½ inches (38 mm)
   3. Concrete not exposed to weather or in contact with earth
      a. Slabs, walls, joists ¾ inch (19 mm)
      b. Beams, columns 1½ inches (38 mm)

3.4 Not Used

3.5 Preparations for Placing Concrete

A. Remove water from excavations. Before placement of concrete, remove wood chips, shavings, and hardened concrete from forms.
   1. Clean all equipment.
   2. Wet forms, except in freezing weather, or oil forms.

B. Earth shall be uniformly moist when concrete is placed. Sprinkling method shall not be such as to form mud or pools of water. Watering subgrade immediately prior to placing concrete is not sufficient to make the soil uniformly moist.

C. Notify other crafts to permit installation of their work. Coordinate installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

3.6 Placing Concrete

A. Notify owner's representative 24 hours in advance prior to concrete placement.

B. Field Inspection: Do not place concrete until forms and reinforcing steel have been inspected and approved.
1. Place Ready-Mix concrete within specified time after batching.
   a. Below 40°F (4°C) See Cold Weather Placing
   b. 40 - 85°F (4 - 29°C) 90 minutes
   c. 86 - 90°F (30 - 32°C) 75 minutes
   d. Above 90°F (32°C) 60 minutes
   e. Concrete exceeding delivery time may be rejected by the SDR.
2. Adding Water: Do not add water after initial introduction of mixing water for batch except when slump of concrete is less than that specified upon arrival at job site, and maximum water/cement ratio for mix has not been exceeded.
   a. Notify owner's representative before adding any water.
   b. Add water to bring slump within specified limits. Turn drum at least 30 additional revolutions at mixing speed. Do not add water to batch at any later time.
   c. Insure that concrete strength meets specified requirements, and water does not exceed maximum amount specified in CONCRETE MIX DESIGN.

C. General: Comply with ACI 304, and as specified herein.
1. Deposit concrete continuously or in layers of such thickness that concrete will not be placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness.
2. If section cannot be placed continuously, provide construction joints as specified herein. Deposit concrete as nearly as practicable to its final location to avoid segregation.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches (610 mm) and in a manner to avoid inclined construction joints.
1. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
2. Consolidate placed concrete by high frequency mechanical vibrating equipment, supplemented as necessary by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
   a. Do not use vibrators to transport concrete inside forms.
   b. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine.
   c. Place vibrators to rapidly penetrate placed layer and at least 6 inches (152 mm) into preceding layer.

d. Do not insert vibrators into lower layers of concrete that have begun to set.
e. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

3. Concrete shall not be allowed to free fall more than 5 feet (1.5 m) unless confined by a closed chute. Concrete placed in walls 10 inches (254 mm) or less in thickness may free fall maximum of 8 feet (2.4 m).

E. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures; comply with ACI 306 and these specifications.

1. Mix and place concrete only when temperature is at least 40°F (4°C) and rising, unless permission to pour is obtained from SDR.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators.
4. When approval is obtained to place concrete at or below an atmospheric temperature of 40°F (4°C), heat water or aggregates, or both. Provide suitable enclosures and heating devices.
   a. Temperature of mixed concrete shall be not less than 50°F (10°C) and not more than 90°F (32°C) at time of placement.
   b. Record temperature of concrete for each truck as delivered and after placement in forms.
   c. Provide heating equipment or methods capable of heating water and aggregates uniformly. Heat materials to temperature not greater than 150°F (66°C).
5. After concrete placement, provide suitable measures to maintain concrete surface temperature at 40°F (4°C) or above for period not less than 7 days.

F. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (32°C).
2. Cover reinforcing steel with water-soaked burlap when required to ensure that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Wet forms thoroughly before placing concrete.
4. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.
5. Record temperature of concrete for each truck as delivered and after placing in forms. Record air content and slump for each truck.

3.7 Concrete Finishing

A. General: Do not use tools such as jitterbugs that force the aggregate away from surface.

1. Do not spray or sprinkle water onto concrete surface to aid in finishing.

2. Avoid bringing more water than necessary to surface and avoid working surface any more than necessary to obtain required finish.

B. Finish of Formed Surfaces
   1. Rough Form Finish: For formed concrete surfaces not exposed-to-view in finish work or by other construction, unless otherwise indicated.
      a. Texture for concrete surface is imparted by form facing material used.
      b. Repair and patch tie holes and defective areas, with fins and other projections exceeding 1/4 inch (6.35 mm) in height rubbed down or chipped off.
   2. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with coating material applied directly to concrete, or covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system.
      a. As-cast concrete surface is obtained with selected form facing material, arranged orderly and symmetrically with minimum of seams.
      b. Repair and patch defective areas with fins or other projections completely removed and smoothed.
      c. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment, not later than 24 hours after form removal.
         1) Moisten concrete surfaces and rub with carborundum brick or other abrasive until uniform color and texture is produced.
         2) Do not apply cement grout other than that created by rubbing process.
      d. Grout-Cleaned Finish: Provide grout cleaned finish, in color and texture, to scheduled concrete surfaces which have received smooth form finish treatment.
         1) Combine one part gray Portland cement to 1½ parts fine sand by volume, and mix with water to consistency of thick paint. Blend standard gray Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.
         2) Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
   3. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 Concrete Curing

A. General: Immediately after placing or finishing, and as soon as operation will not mar finish, concrete surfaces not covered by forms shall be protected against moisture loss.
   1. Maintain protection for period of at least 7 days.
   2. Where formed surfaces are cured in forms, forms shall be kept continually wet.

3. If forms are removed before end of curing period, continue curing as on unformed surfaces, using curing materials specified herein.
4. Keep surfaces free of foot and vehicular traffic during curing period.

B. Curing Methods: Provide curing of concrete by methods specified or by combinations thereof, as approved:
1. Polyethylene Coated Burlap Mats: Cover surfaces with specified mat lapped 12 inches (305 mm). Mat shall be weighted to prevent displacement. Immediately repair tears or holes by patching.
2. Membrane Forming Curing Compound: Apply in two coat continuous operation, using not less than manufacturer's recommended rate of application. If unknown, apply at rate of 1 gallon (3.8 liters) per 200 square feet (18.6 square meters) for each coat.
   a. Respray surfaces damaged by construction operations during curing.
   b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete or with covering material bonded to concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting and other coatings and finish materials, unless otherwise acceptable to SDR.
3. Water Curing: Water cure surfaces indicated to receive additional concrete or concrete fill, dustproofing and hardening treatments, stucco, plaster, or painting.

3.9 Removal of Forms

A. General: Do not remove forms for any portion of the structure until concrete is strong enough not to be damaged when forms are removed.
1. Remove forms without damage to concrete.
2. Do not use bars or heavy tools against concrete in form removal.
3. Promptly repair concrete found defective after form removal.

B. If field operations are not controlled by cylinder tests, the following periods, exclusive of days when the temperature is below 40°F (4°C), may be used as a guide for removal of forms and supports:
1. Guide for Removal of Forms and Supports

a.	Centering under beams	14 days
b.	Elevated floor slabs	7-14 days*
c.	Walls	12-24 hours*
d.	Columns	1-7 days*
e.	Sides of beams and all other parts	12-24 hours*

*Longer time dictates unless SDR approves lesser time.

C. If field operations are controlled by beam or cylinder tests, forms may be removed from centering under beams and floor slabs when 2,500 psi (17.2 MPa) compressive strength is attained, and approved by SDR.

D. Do not place superimposed loads on or against load carrying members until 2,500 psi (17.2 MPa) compressive strength has been attained, and approved by SDR.

E. Sidewalk Forms: Do not remove side forms for 12 hours after completion of finishing.

F. Curb and Gutter Forms: Remove forms of curb front not less than 2 hours or more than 6 hours after placement of concrete.
   1. Forms of curb back shall remain in place until face and top of curb have been finished as specified for concrete finishing.
   2. Do not remove gutter forms while concrete is sufficiently plastic to slump in any direction.

3.10 Reuse of Forms

A. Clean and repair surfaces of forms to be reused in work.

B. Maintain shape, strength, rigidity, water-tightness, and surface smoothness of reused forms at all times.

C. Resize warped or bulged lumber before use.

D. Do not use unsatisfactory forms.

3.11 Concrete Surface Repairs

A. Patching Defective Areas: Immediately after form removal, cut out honeycomb, rock pockets, voids over ¼ inch (6.35 mm) in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch (25 mm).
   1. Cut edges perpendicular to concrete surface.
   2. Thoroughly clean, dampen with water, and brush coat area to be patched with neat cement grout or proprietary bonding agent before placing cement mortar or proprietary patching compound.

B. Exposed-To-View Surfaces: Blend white Portland cement and standard Portland cement so that patching mortar will match surrounding color when dry.
   1. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching.
   2. Compact mortar in place and strikeoff slightly higher than surrounding surface.

C. Repair of Formed Surfaces: Remove and replace concrete with defective surfaces if defects cannot be repaired to satisfaction of SDR.
   1. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning.
   2. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.
   3. Where possible, repair concealed formed surfaces that contain defects that affect concrete durability. If defects cannot be repaired, remove and replace concrete.

D. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. For unformed surfaces sloped to drain, use template having required slope to test for trueness.
   1. Surface defects include crazing, cracks greater than 0.01 inch (0.25 mm) wide or which penetrate to reinforcement or completely through non-reinforced sections

regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

2. Repair finished unformed surfaces that contain defects which affect concrete durability.
3. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
4. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish to blend into adjacent concrete. Use only approved proprietary patching compounds.
5. Repair defective areas, except random cracks and single holes not exceeding 1 inch (25 mm) diameter, by cutting out and replacing with fresh concrete.
    a. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least ¾inch (19.1 mm) clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and brush with neat cement grout, or apply concrete bonding agent.
    c. Mix patching concrete of same materials to provide concrete of same type of class as original concrete.
    d. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

3.12 Concrete Truck Discharge

A. Excess Concrete: Discharge excess concrete in mixer trucks that cannot be immediately used to area where it will not create an obstruction or hazard during construction. Remove excess concrete from site in a timely manner to site approved by SDR.

B. Wash Water Discharge: Discharge wash water from mixer trucks to ground surface in manner and at location where discharge cannot escape construction site, or be washed away to arroyos, storm sewers, or sanitary sewers by precipitation or other surface flows.
    1. Prior to project completion, remove wash water residue from site to location approved by Owner’s representative.
    2. Clean wash water discharge site to be free of debris.

END OF SECTION

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 GENERAL

1.1 Summary

A. Section includes: All masonry work shown on the Drawings. It also includes providing openings in masonry, to accommodate the Work under other Sections, and building into the masonry all items such as sleeves, anchor bolts, inserts, and all other embedded items for which placement is not specifically provided under other Sections.

1.2 References

A. American Concrete Institute (ACI)
1. ACI 315, “Manual of Standard Practice for Detailing Reinforced Concrete Structures.”

B. American Society for Testing and Materials (ASTM)
1. ASTM A36, Carbon Structural Steel, Standard Specification for.
2. ASTM A82, Steel Wire, Plain, for Concrete Reinforcement, Standard Specification for.
3. ASTM A153, Zinc Coating (Hot Dip) on Iron and Steel Hardware, Standard Specification for.
4. ASTM A167, Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip, Standard Specification for.
5. ASTM A240, Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels, Standard Specification for.
6. ASTM A366, Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality, Standard Specification for.
7. ASTM A569, Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial Quality, Standard Specification for.
8. ASTM A580, Stainless Steel Wire, Standard Specification for.
9. ASTM A615, Deformed and Plain Billet Steel Bars for Concrete Reinforcement, Standard Specification for.
10. ASTM A663, Steel Bars, Carbon, Merchant Quality, Mechanical Properties, Standard Specification for.
11. ASTM C5, Quicklime for Structural Purposes.
12. ASTM C67, Standard Methods of Sampling and Testing Brick.
13. ASTM C90, Load-bearing Concrete Masonry Units, Standard Specification for.
14. ASTM C91, Masonry Cement.
15. ASTM C136, Sieve or Screen Analysis of Fine and Coarse Aggregates.
16. ASTM C140, Sampling and Testing Concrete Masonry Units, Standard Test Methods of.
17. ASTM C144, Aggregate for Masonry Mortar.
18. ASTM C150, Portland Cement.
19. ASTM C180, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

20. ASTM C207, Hydrated Lime for Masonry Purposes.
21. ASTM C270, Mortar for Unit Masonry.
22. ASTM C404, Aggregates for Masonry Grouts.
23. ASTM C426, Linear Drying Shrinkage of Concrete Masonry Units, Standard Test Method for.
24. ASTM C476, Grout for Masonry.
25. ASTM C744, Prefaced Concrete and Calcium Silicate Masonry Units, Standard Specification for.
26. ASTM C1019, Standard Test Method of Sampling and Testing Grout.
27. ASTM D2240, Rubber Property - Durometer Hardness, Standard Test Method for.
28. ASTM E84, Surface Burning Characteristics of Building Materials, Standard Test Method for.
29. ASTM E119, Fire Tests of Building Construction and Materials, Standard Test Methods for.

C. Brick Institute of America
1. “Technical Notes on Brick and Tile Construction.”
2. Technical Bulletin 1A, "Construction and Protection Recommendations for Cold Weather Masonry Construction."

D. National Concrete Masonry Association,
1. “Guide Specifications”
2. “Technical Bulletins.”

E. Underwriters Laboratories (UL)
1. Design Numbers U901 through U914.

1.3 System Description

A. Coordination:
1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the masonry work.
2. Masonry work advanced without built-in flashings and other items shall be removed and rebuilt, at no additional cost to Owner, even if discovered after masonry has been completed.
3. Coordinate the work of other Sections to avoid delay of the masonry work.

1.4 Submittals

A. Shop Drawings:
1. Complete layout of all masonry walls showing modular planning and all special shapes to be used. Show all details for each condition encountered in the Work. Provide plans and elevations drawn at ¼-inch scale and details drawn at 1½-inch scale. Show all items required to be built into masonry.
2. Masonry control joints. Show all locations and details.
3. Fabrication, bending, and placement of reinforcing bars. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcing for masonry Work.

4. Explanation of where each masonry accessory will be used in the Work, quantities purchased and intended spacing.

B. Samples:
1. One unit of each type of concrete masonry unit specified.
2. One unit or one modular length of each accessory item specified.
3. Each type of colored mortar, showing the range of color that can be expected in the Work.

C. Product Data:
1. Complete selection of manufacturer's standard and custom colors.
2. Mix designs for grout and mortar.
3. Manufacturer's specifications and instructions for each manufactured product. Include data substantiating that materials comply with specified requirements.

1.5 Quality Assurance

A. Requirements of Regulatory Agencies:
1. Comply with the applicable requirements of International Building Code, including the requirements for Special Inspection.
2. Wherever a fire resistance classification is shown or scheduled for masonry Work (4 hour, 3 hour, and similar designations), comply with applicable requirements for materials and installation established by UL and other governing authorities.

B. Source Quality Control:
1. Obtain all concrete masonry units from one manufacturer, cured by one process and of uniform texture and color or in an established uniform blend thereof. Cure units by autoclave treatment at minimum temperature of 350°F, and a minimum pressure of 125 psi.
2. Do not change source or brands of materials during the course of the Work.
3. No change shall be made in the proportions for mortar or grout, unless resubmitted and re-approved by the Engineer.

C. Construction Tolerances:
1. Variation from Plumb: For lines and surfaces of columns, walls, and expansion joints, do not exceed ¼ inch in 10 feet, or ⅜ inch in one story height or 20 feet maximum, or ½ inch in 40 feet or more.
2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed ¼ inch in any bay or 20 feet maximum, or ¾ inch in 40 feet or more.
3. Variation of Linear Building Line: For position shown and related portion of columns, walls and partitions, do not exceed ½ inch in any bay or 20 feet maximum, or ¾ inch in 40 feet or more.
4. Variation in Cross Sectional Dimensions: For columns and thickness of walls, do not exceed +½ inch -¼ inch from dimensions shown.

D. Job Mock up: Prior to installation of masonry Work, but after Engineer's approval of samples, erect job mock up using materials, pattern bond and joint tooling shown or specified for final Work.

1. Provide special features, including finished opening 16-inch x 16-inch and finished end.
2. Build mock up at the site, in location approved by Engineer, of full required wall thickness and approximately 4 feet x 4 feet, unless otherwise shown.
3. Indicate the proposed range of color, texture, and workmanship to be expected in the completed Work.
4. Obtain Engineer's acceptance of the mock up before start of Work.
5. Retain and protect mock up during construction as a standard for judging completed masonry. Do not alter, move, or destroy mock up until given written permission by Engineer.
6. Build as many job mock up panels as required to obtain Engineer's acceptance of the Work.
7. Masonry construction that does not meet the standards approved on the sample panel shall be removed and rebuilt as required by Engineer.

E. Conference: Prior to the installation of masonry Work, Contractor shall schedule a Conference at the project site.
1. Review foreseeable methods and procedures related to the masonry Work including, but not necessarily limited to, the following:
   a. Project requirements, including Contract Documents.
   b. Method of sequence of masonry construction.
   c. Special masonry details.
   d. Required submittals, both completed and yet to be completed.
   e. Standards of workmanship.
   f. Quality control requirements.
   g. Job organization and availability of materials, tradesmen, equipment, and facilities needed to make progress and avoid delays.
   h. Modular planning requirements.
   i. Weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
   j. Required inspection, testing, and certifying procedures.
   k. Regulations concerning building code compliance.
2. Attendance is mandatory for the following:
   a. Contractor’s job superintendent.
   b. Masonry subcontractor’s job superintendent.
   c. Masonry subcontractor’s foreman.
   d. Authorized representative of concrete unit masonry supplier.
   e. Engineer's authorized representative.
3. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration and to resolve any outstanding issues.
4. Contractor shall record the discussions of the conference and the decisions and agreements (or disagreements) and furnish a copy of the record to each party attending.

1.6 Product Delivery, Storage, and Handling

A. Delivery of Materials:

1. Deliver concrete masonry units in original, unopened, and undamaged packages and pallets, plainly marked with identification of materials and name of approved manufacturer. Delivery shall be by the manufacturer or manufacturer's agent.
2. Deliver reinforcing to the site, bundled, tagged, and marked. Use metal tags indicating size, lengths, and other markings shown on approved Shop Drawings.
3. Manufactured materials, such as cement and lime, shall be delivered and stored in their original containers plainly marked with identification of materials and manufacturer.

B. Storage of Materials:
1. Store materials off the ground, protected from dirt, construction traffic, and contamination. Cover using tarpaulins or polyethylene sheets to prevent damage such as wetting, staining, and chipping.
2. Do not stack concrete masonry units higher than recommended by manufacturer.

C. Handling Materials:
1. Handle materials in a manner that minimizes chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished Work.

1.7 Job Conditions

A. Site Facilities: Supplemental heat sources, as may be required, should Contractor wish to continue masonry Work in cold weather if not available at the project site. The provision of all supplemental heat energy sources and equipment is the responsibility of Contractor.

B. Environmental Requirements:
1. Do not place any masonry Work when air temperature is below 28°F, on rising temperatures or below 36°F, on falling temperatures, without temporary heated enclosures or without heating materials or other precautions necessary to prevent freezing.
2. No frozen materials shall be used, nor shall frozen masonry Work be built upon.
3. Remove and replace all masonry Work damaged by frost or freezing.

C. Protection:
1. Protect all masonry against freezing for at least 48 hours after being placed.
   a. Mean Daily Air Temperature 40°F to 32°F: Protect masonry from rain for 48 hours after installation.
   b. Mean Daily Temperature 32°F to 20°F: Completely cover masonry with insulating blankets for 48 hours.
   c. Mean Daily Air Temperature 20°F and Below: Maintain masonry above 32°F for 48 hours by enclosure and supplementary heat.
2. Protect partially completed masonry against rapid heat loss and from water entering it when Work is not in progress, by covering top of walls with strong, waterproof, non-staining membrane. Extend membrane at least 2 feet down both sides of walls and secure in place using wall cover clamps spaced at intervals of 4 feet and at each end and joint of covering.
3. Do not apply distributed floor or roof loading for at least 3 days after completing masonry columns or walls.
4. Do not apply concentrated loads for at least 7 days after completing masonry columns or walls.

D. Cold Weather Masonry Work:
1. All mortar for use in masonry Work, when the mean daily temperature is below 40°F, shall be Portland cement lime sand mortars using high early strength Portland cement.
2. Air Temperature 40°F to 32°F: Heat sand or mixing water to 70°F to 160°F.
3. Air Temperature 32°F to 20°F: Heat sand and mixing water to 70°F to 160°F. Provide heat on both sides of wall under construction. Employ wind breakers when wind speed is in excess of 15 mph.
4. Air Temperature below 20°F: Heat sand and mixing water to 70°F to 160°F. Provide enclosure and auxiliary heat to maintain air temperature above 32°F. Temperature of masonry units when laid shall not be less than 20°F.

E. Hot Weather Masonry Work: Protect masonry Work, by methods acceptable to Engineer, from direct exposure to wind and sun when the surrounding air temperature is 95°F in the shade with relative humidity less than 50%.

PART 2 PRODUCTS

2.1 General Concrete Unit Masonry

A. General: Unless specifically modified by other requirements specified, provide concrete masonry units in compliance with the following classifications, weights, grades, colors, textures, scores, thermal resistance values, and other features specified.

B. Hollow Load-Bearing Concrete Masonry Units: Provide the following:
1. ASTM C90, Grade N, Type I, medium weight.
2. Minimum Compressive Strength: 1,900 pounds per square inch average of three units; 1,700 pounds per square inch minimum for an individual unit. The manufacturer shall certify that the masonry units meet all requirements of ASTM C90 including the moisture content and linear shrinkage requirements for intermediate conditions.

C. Color and Texture: Provide the following:
1. Manufacturer’s complete selection of all standard and all custom colors. Submit preliminary color selection for review by Engineer and Owner.
2. Color, surface texture, and aggregate uniform within the normal range established by sample submission and as approved by Engineer and Owner.

D. Special Shapes: Provide the following where required:
1. Lintels, bond beams, reinforcing units, and flush-end reinforcing units, interior and exterior corner shapes, solid jambs, sash block, coves, premolded control joint blocks, headers, and other special conditions.
2. Split-face, scored, and other facings, and special sizes, as shown on the Drawings.

E. Waterproofing Admixture: Manufacture all types of concrete unit masonry, used in construction of exterior walls with an integral waterproofing admixture as follows:
1. Material: Cross-linking acrylic polymer.
2. Proportion: In strict accordance with manufacturer's instructions.
3. Product and Manufacturer: Provide one of the following:

a. DRY BLOCK System by Forrer Industries, a Unit of W. R. Grace & Company Construction Products Division.
b. ADDIMENT Block Plus W-10 System by Addiment Incorporated.
c. Or equal.

2.2 Mortar

A. General: Anti-freeze admixture or agents, including calcium chloride are not permitted.

B. Mortar for All Unit Masonry: Type S. Comply with ASTM C270, Table 2, except limit materials to those specified herein.
1. Portland Cement-Lime: Provide the following proportions by volume:
a. Portland Cement: 1 part.
b. Hydrated Lime or Lime Putty: ¼ to ½.
c. Aggregate (sand in damp, loose condition): 2¼ to 3 times the sum of cementitious materials.
d. Pigment: as required to match approved sample.
2. Properties:
a. Average Compressive Strength, ASTM C270: 1,800 pounds per square inch.
b. Minimum Water Retention, ASTM C270: 75%.
c. Maximum Air Content, ASTM C270: 12% for Portland cement - lime mortars.

2.3 Masonry Grout

A. Mixes subject to the following limitations:
1. Specified 28 day Compressive Strength: 2,000 psi
2. Minimum Cement Content: 658 lb/cu yd
3. Maximum Water Cement Ratio by Weight: 0.50
4. Slump at point of placement: 6 inches ± 1 inch

B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for grout required. Comply with ACI 211.1.

2.4 Materials

A. Portland Cement:
1. ASTM C150: Use Type II.
2. Non-staining and of natural color or as required to be compatible with the approved pigment.

B. Hydrated Lime: ASTM C207, Type S, or lime putty ASTM C5.

C. Aggregates: ASTM C33 and as herein specified.
1. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed surfaces.
2. Fine Aggregate: Clean, sharp, natural sand, free from loam, clay, lumps, or other deleterious substances. For mortar, ASTM C144, except for mortar for joints less than ¼-inch use aggregate graded with 100% passing the No. 16 sieve.

3. Colored/White Mortar Aggregates: Provide ground marble, granite or other sound stone, as required to match the approved sample.
4. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
   a. Crushed stone, processed from natural rock or stone.
   b. Washed gravel, natural or crushed. Use of slag and pit or bank run gravel is not permitted.
   c. Coarse Aggregate Size: ASTM C33, No. 8 or 89.

D. Admixtures:
1. Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes.
2. Waterproofing Admixture for Exterior Concrete Unit Masonry: Provide a cross-linking acrylic polymer integral waterproofing system, proportioned and mixed in strict accordance with manufacturer's instructions. Provide one of the following:
   a. DRY-BLOCK Mortar Admix by Forrer Industries a unit of W.R. Grace & Company Construction Products Division.
   b. ADDIMENT Block Plus W-10 by Addiment Incorporated.
   c. Or equal.

E. Colored Mortar Pigments:
1. Commercial iron oxide, manganese dioxide, ultramarine blue, chromium oxide, or carbon black, compounded for use in mortar mixes.
2. Do not exceed pigment to cement ratios, by weight, of 1 to 35 for carbon black and 1 to 7 for other pigments.
3. Product and Manufacturer: Provide one of the following:
   a. Truetone Mortar Colors by Frank D. Davis Co., subsidiary of Rockwood Industries, Inc.
   b. Sonobrite by Sonneborn Building Products Division Rexnord Chemical Products, Inc.
   c. Or equal.

F. Water: Clean and free from injurious amounts of oils, acids, alkalis, or organic matter.

2.5 Reinforcing

A. Reinforcing Bars: ASTM A615, Grade 60 for all bars. Shop fabricated reinforcing bars that are shown or required to be bent or hooked. Comply with ACI 315 for the fabrication of reinforcing steel for masonry Work.

B. Wire products: Ties and rebar positioners shall be fabricated from cold drawn steel wire complying with ASTM A82 and hot-dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A153.

C. Rebar Positioners: Nine gage reinforcing bar positioners that accommodate both horizontal and vertical reinforcing steel. Provide one of the following:
1. #RB Series Rebar Positioners by Hohmann & Barnard, Inc.
2. Or equal.

PART 3 EXECUTION

3.1 Inspection

A. Contractor and his installer shall examine areas and conditions under which masonry Work is to be installed, and notify Engineer, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.2 Installation, General

A. Build chases and recesses as shown or required by others. Provide not less than 8 inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

B. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting of masonry Work. After installation of said items, complete masonry Work to match Work immediately adjacent to openings.

C. Cut masonry units using motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full size units without cutting wherever possible.

3.3 Laying Masonry Walls

A. General:
1. Lay out walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, masonry control joints, returns and offsets. Avoid the use of less than half-size units at corners, jambs, and wherever possible at other locations.
2. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other Work.
3. Pattern Bond:
   a. Lay all concrete masonry Work in running bond with vertical joints in each course centered on units in courses above and below unless otherwise shown.
   b. Bond and interlock each course of each wythe at corners.
   c. Do not use units with less than 8-inch horizontal face dimensions at corners or jambs.

B. Mortar Bedding and Jointing:
1. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
   a. Lay walls with ⅜-inch joints.
2. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials, except paint, unless otherwise shown.
3. Tool exposed joints when mortar is “thumbprint” hard, slightly concave, unless otherwise required to match existing joint treatment. Rake out mortar in preparation for application of caulking or sealants where required.

4. Concave tool exterior joints below grade.
5. Do not use mortar that has begun to set or if more than 30 minutes have elapsed since initial mixing. Do not retemper mortar.
6. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

C. Stopping and Resuming Work: Rack back ½ unit masonry length in each course, and do not tooth. Clean exposed surfaces of set masonry, wet units lightly, if required, and remove loose masonry units and mortar prior to laying new masonry.

D. Built in Work: As the Work progresses, build in items shown, specified or required by others. Fill cores in one block width solidly with masonry grout around built in items.

E. Structural Reinforced Masonry:
1. Shape and dimension reinforcement as shown and are required by governing codes.
2. Position reinforcing accurately at the spacing shown. Support and secure vertical bars against displacement with rebar positioners.
3. For columns, piers, and pilasters, provide a clear distance between vertical bars as shown, but not less than 1½ inches. Provide lateral ties.
4. For horizontal bars, provide fully lapped "L" shaped corner bars at corners and intersections.
5. Provide lapped splices with reinforcing steel placed in contact with rebar positioners or tied. Provide 48 bar diameter lap length, unless otherwise shown.

F. Grouting Structural Reinforced Masonry:
1. Solid grout all walls, beams, piers and pilasters.
2. Provide temporary dams where required or barriers to control horizontal flow of grout at ends of wall sections. Build dams full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completion of grout pour.
3. Use low lift (<60-inch) grouting techniques for columns, piers and pilasters, and for walls with grout spaces wider than 2 inches.
4. Grout spaces less than 2 inches in width at intervals not to exceed 24 inches in lifts of 6 to 8 inches.
5. Terminate pour 1½ inches below top of highest course in pour.
6. Provide metal wall ties, if required, to prevent blow outs.

3.4 Anchoring Masonry Work

A. Anchor masonry to structural members where masonry abuts or faces, such members to comply with the following:
1. Provide an open space, not less than ½ inch in width, between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown.

3. Space anchors as shown, but not more than 8 inches on center vertically and 36 inches on center horizontally.
4. Provide end blocks, where masonry abuts structural support, to facilitate installation of compressible filler, backer rod, and sealant.

B. Lintels and Bond Beams: Provide masonry lintels and bond beams where shown. Use specially formed "U" shaped lintel and bond beam units with reinforcing bars placed as shown, filled with grout. Temporarily support formed-in-place lintels and bond beams.

3.5 Repair, Pointing, and Cleaning

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings, and adjacent Work to provide a neat, uniform appearance, properly prepared for application of sealant compounds.

C. Cleaning Exposed, Unglazed Masonry Surfaces:
1. Wipe off excess mortar as the Work progresses. Dry brush at the end of each day’s Work.
2. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as described below. Obtain Engineer's acceptance of sample cleaning before proceeding to clean remainder of masonry Work.
   a. Dry clean to remove large particles of mortar using wood paddles and scrapers. Use chisel or wire brush if required.
   b. Presoak wall by saturating with water and flush off loose mortar and dirt.
   c. Acid-type cleaners shall not be permitted.
   d. Protect other Work from cleaning operations.

D. Protection: Protect the masonry Work from deterioration, discoloration, or damage during subsequent construction operations.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 Summary

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

1.2 Electrical Division Index

A.	26 05 01	Common Work Results for Electrical
B.	26 05 19	Low-Voltage Electrical Conductors and Cables
C.	26 05 33.13	Conduit for Electrical Systems
D.	26 25 33.16	Boxes for Electrical Systems
E.	26 05.53	Identification for Electrical Systems
F.	26 06 26	Grounding and Bonding for Electrical Systems
G.	26 22 00	Low-Voltage Transformers
H.	26 24 16	Panelboards
I.	26 27 16	Electrical Cabinets and Enclosures
J.	26 27 26	Wiring Devices

1.3 Requirements

A. Furnish all labor, materials, service, equipment, and appliances required to complete the installation of the complete Electrical System in accordance with the Specifications and Contract Drawings.

1.4 Requirements of Regulatory Agencies and Standards

A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the National Electrical Code (NEC), the National Electrical Safety Code (NESC) and the terms and conditions of the Electrical Utility and other authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations and authorities shall be made by the Contractor without additional charge.

B. Underwriters Laboratories (UL) or Factory Mutual (FM): All materials, appliances, equipment or devices shall conform to the applicable standards of Underwriters Laboratories, Inc. or Factory Mutual, Inc. The label of, or listing by, UL or FM is required.

C. Standards: Where referenced in these Specifications or on the Drawings, the publications and standards of the following organizations shall apply: American Society of Testing and Materials (ASTM), Insulated Power Cable Engineers Association (IPCEA), National Fire Protection Association (NFPA), American National Standards Institute (ANSI), and National Electrical Manufacturers Association (NEMA).

D. Conflicting code requirements shall be brought to the attention of the Engineer. Where two or more codes apply, the most stringent of the codes shall govern.

1.5 Submittals and Substitutions

A. Material List: Within 30 days of Contract Award or Notice to Proceed and before material is ordered, the Contractor shall submit for approval a list of all proposed material and equipment, indicating manufacturer's name and general description.

B. Shop Drawings: Submit for approval a minimum of six copies of all shop drawings no later than 30 days after the material list has been approved and prior to ordering any material. Show complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation. Indicate in the transmittal that submittal has been reviewed and accepted and all Contract deviations identified. In addition to specific references or requests; submit shop drawings for the following applicable items: panelboards, transformers, primary cable and gear, alarm systems and all special equipment.

C. Substitutions may be requested in accordance with the specification.

PART 2 PRODUCTS

2.1 Equipment Requirements

A. The Electrical requirements for equipment specified or indicated on the Drawings are based on information available at the time of design. If equipment furnished for installation has Electrical requirements other than indicated on the Electrical Drawings, the Contractor shall make all adjustments to wire and conduit size, controls, overcurrent protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. All adjustments to the Drawings reflecting the Electrical System shall be delineated in a submittal to the Owners Representative immediately upon knowledge of the required adjustments. The complete responsibility and costs for such adjustments shall be assigned to the respective section of these Specifications in which the equipment is furnished.

2.2 Materials

A. All similar materials and equipment shall be the product of the same manufacturer.

B. Where no specific material, apparatus, or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the Contract requirements and meets the approval of the Owners Representative.

C. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.

D. All equipment and material that is provided shall meet the Buy American Act.

2.3 Altitude

A. Equipment affected by altitude shall perform satisfactorily the function intended at the altitude of the project site.

PART 3 EXECUTION

3.1 General

A. Fabrication, erection, and installation of the complete Electrical System shall be done in a first class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project. The Contractor shall check all areas and surface where Electrical equipment or material is to be installed, removed or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies this Contractor's acceptance of the prevailing conditions.

3.2 Temporary Power and Lighting

A. Furnish and install all temporary Electrical facilities required for construction and safety operation. No part of the permanent Electrical Systems or the existing Electrical System may be used for temporary service unless approved by the Owners Representative.

3.3 Utilities

A. General: The Drawings reflect requirements of the serving utilities based on information derived from representatives of the utilities.

3.4 Excavation

A. Comply with Earthwork section.

3.5 Performance Tests

A. Thoroughly test all fixtures, services and all circuits for proper operating conditions and freedom from grounds and short circuits before acceptance is requested. All equipment appliances and devices shall be operated under load conditions.

B. After the interior-wiring system installation is complete and at such time as the Owners Representative may direct, conduct operating tests for approval. When requested, test all the wire, cable, devices and equipment after installation to assure that all material continues to possess all the original characteristics as required by the governing codes and standards as listed in these Specifications.

C. After substantial completion and after power loads have been established, make voltage readings at all panelboards. Based on these readings make final adjustments of taps on all transformers in the building as directed. Submit to Engineer correspondence and/or drawing delineating readings.

D. Perform such other tests as required by other sections of these Specifications or as requested by the owner to prove acceptability.

E. Furnish all instruments and labor for testing.

3.6 Operating Instructions And Manuals

A. Instructions: Without additional charge to the Owner, the Contractor shall provide an experienced and competent representative to instruct the Owner or his representative fully in the concept, theory, operations, adjustment, and maintenance of all equipment furnished for the Electrical System. Contractor shall provide at least two weeks' notice to the Engineer in advance of this period.

B. Manuals: Upon completion of the work, prepare and deliver to the Owner two sets of complete operating and maintenance manuals for the systems and major equipment installed. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data. Operating and maintenance manuals as required herein shall be submitted to the Owners Representative for review and distribution to the Owner not less than two weeks prior to the scheduled final acceptance of the Project.

C. Other: The above requirements are in addition to specific instruction and manuals specified for individual systems or equipment.

3.7 Drawings

A. General: The Electrical Drawings show the general arrangement of all conduit, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit. The Civil Structural Drawings shall be considered as a part of the work insofar as these Drawings furnish the Contractor with information relating to the design and construction of the building. Civil Drawings shall take precedence over Electrical Drawings. The Contractor shall investigate the civil and finish

conditions affecting the work and shall arrange his work accordingly, providing such fittings, elbows, pullboxes, and accessories as may be required to meet such conditions.

B. Field Measurements: The Contractor shall verify the dimensions governing the Electrical work at the building. No extra compensation shall be claimed or allowed on account of differences between actual dimensions and those indicated on the Drawings.

3.8 Location of Equipment and Outlets

A. The approximate locations of cabinets, panelboards, wiring gutters, switches, light outlets, power outlets, etc., are indicated on the Drawings; however, the exact location shall be determined after thoroughly examining the general building plans and by actual measurements during construction to avoid conflicts with any or other trades with all locations subject to the approval of the Engineer.

B. Verify all locations of conduit, boxes, etc., stubbed in the floor prior to installation.

3.9 Identification and Signs

A. Mark each individual motor controller, disconnect switch and remote control device to identify each item with its respective service using engraved nameplates.

B. Provide nameplates with engraved lettering not less than ⅜ inch high where specified or noted. In general, use white core laminated plastic, attached with screws. Embossed plastic adhesive tape is not acceptable. Flush mounted devices may have identification engraved in the device plate.

C. Identify panelboards, transformers and cabinets by engraved nameplates with descriptions indicated on the Drawings together with indication of the location of the feeder overcurrent protection. Install on inside of hinged doors or panelboards and cabinets.

1. Example:
   Panel 2P
   120/208V, 3-phase, 4-wire
   Fed from Panel MDP/cct. #4

D. Provide warning signs on all equipment or devices operating at 300 volts or more, reading “DANGER-480 VOLTS,” etc. with white letters on red background of standard code size. Signs shall be decals.

E. All underground utilities indicated on the Drawings shall have a 6-inch-wide plastic marker installed continuously in the trench at 12 inches below grade. The marker shall have continuous markings embossed in the tape identifying the system installed (i.e., communications, telephone, power, and secured computer).

F. Identify all exposed conduits, junctions, and pullboxes at maximum intervals of twenty feet and as indicated below. Identify exposed conduits according to the system carried by means of Brady #B-350 permacode thin film pipe markers or approved equal by the Owner. Identify junction and pullboxes by painted on stencils or approved labels.

Identification shall be placed at necessary intervals on straight conduit runs, close to all terminations, adjacent to all changes in directions and where conduits pass through walls or floors. Stencils to be painted on with legible contrasting colors without abbreviations. Painting shall be in accordance with DIVISION 9 - FINISHES.

1. Approved Electrical Conduit Color Codes:
    a. 120/208 Volt Black
    b. Grounding Green
    c. 110 Volt Control Black/White

G. Identify all receptacle and switch devices with the circuit and overcurrent protection device. Identification may be by waterproof, permanent marker on the rear of the device cover plate or as approved by the Owners Representative and Owner.

3.10 Warranty

A. Deliver originals of all guarantees and warranties on this portion of the work to the Owner’s Representative. Warrant all equipment, materials, and workmanship for one year in accordance with the terms of the Contract.

3.11 Product Handling

A. Use all means necessary to protect Electrical materials and equipment before, during and after installation and to protect the installed work of other trades.

3.12 Record Drawings

A. As part of this Contract, the Contractor shall provide a complete marked-up set of Contract Documents indicating all changes to the documents during the project construction phase to the Owner’s Representative. Changes to the Electrical System shall be documented on a set of "Record Drawings" on a daily basis.

END OF SECTION

SECTION 26 05 83

LOW-VOLTAGE ELECTRICAL CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 Related Work Specified Elsewhere

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. 26 05 00 Common Work Results for Electrical

C. 26 06 26 Grounding and Bonding for Electrical Systems

PART 2 PRODUCTS

2.1 Wires and Cables (600 Volts)

A. Type:
1. Conform to the applicable UL and IPCEA Standards for the use intended. Copper conductors with 600 volt insulation unless otherwise specified or noted on the Drawings. Stranded conductors for No. 6 and larger and where elsewhere specified or noted on the Drawings.
2. All conductors shall be copper. Aluminum conductors will be permitted only on 600 volt and above systems.

B. Insulations: Type THWN insulation unless otherwise specified or noted on the Drawings. Type THWN minimum or type XHHW filled cross linked polyethylene 90°C thermosetting insulation for conductors larger than No. 6 and elsewhere as required by NEC.

C. Size: No. 12 minimum unless otherwise specified or noted on the Drawings. Not less than NEC requirements for the system to be installed.

D. Color Coding: Phase, neutral and ground conductors color coded in accordance with NEC. Connect all conductors of the same color to the same phase conductors.

	Phase A	**Phase B**	**Phase C**	**Neutral**
120/240V/1 Phase	Black	Red		White
208Y/120V/3 Phase	Black	Red	Blue	White

Ground shall be Green for all systems.

E. Conductors No. 12 and 10 shall be solid color compounded for the entire length and each like color shall be connected only to the particular phase throughout the project. Conductor sizes larger than No. 10 may be color-coded at each termination and in each

box or enclosure with six inches of half lapped ¾-inch pressure sensitive, plastic tape of respective colors in lieu of solid color compound.

2.2 Vertical Cable Supports

A. Split wedge type supports which clamp each individual conductor and tightens due to weight of the cable shall be used without metallic sheath.

2.3 Connectors and Lugs

A. For copper conductors No. 6 and smaller: 3M Scotch Lok or T & B Sta Kin, or equal compression or indent type connectors with integral or separate insulating caps.

B. For copper conductors larger than No. 6: Solderless, indent, hex screw, or bolt type pressure connectors, properly taped or insulated.

2.4 Tape

A. Plastic tape, 8.5 mils minimum thickness, 1,000,000 megohms minimum insulation resistance, oil resistant vinyl backing, oil resistant acrylic adhesive, incapable of supporting combustion per ASTM D 1000. Equal to 3 M Super 88 Tape.

2.5 Feeder Circuits

A. Single conductor feeder cables shall be of the size and type as indicated on the Drawings. Sizes shown are for copper conductors unless otherwise noted on Drawings.

2.6 Branch Circuits

A. Branch circuits shall be No. 12 AWG copper minimum and shall be larger AWG size where indicated on Drawings. Where branch circuits exceed 70 feet in length, the AWG size shall be increased to accommodate voltage drop.

B. Branch circuits to all equipment, fixtures, and outlets shall include a white neutral and green wire equipment ground.

2.7 Terminations

A. Cold shrink stress relief cones shall be installed at all terminations where shielded cable is used and shall be installed in strict accordance with the recommendations of Electro Products Division/3M.

PART 3 EXECUTION

3.1 Wire And Cable Tests (600 Volts)

A. Measure the insulating resistance of service entrance conductors, feeder circuit conductors and service ground. Measurements shall be taken between conductors and

between conductors and ground. Resistance shall be 1,000,000 ohms or more when tested at 500 volts by megger without branch circuit loads. Tests and procedures shall meet the approval of the Owners Representative, and shall be in accordance with the applicable IPCEA standards for the wires and cables to be installed. Furnish all instruments, equipment and personnel required for testing, and conduct tests in the presence of the Owner's Representative. Submit written reports of the tests and results when requested by the Engineer.

3.2 Splices (480 Volts and Under)

A. Permitted only at outlets or accessible enclosures. Conductor lengths shall be continuous from termination to termination without splices unless approved by the Engineer.

3.3 Pull Wires

A. In each empty conduit, except underground conduits, install a plastic line having tensile strength of not less than 200 pounds. In each empty underground conduit, install a No. 10 AWG bare, hard drawn copper pull wire or a plastic line having a tensile strength of not less than 200 pounds.

3.4 Raceways

A. Install in rigid conduit, EMT, or flexible metallic conduit, unless otherwise specified or noted on the Drawings.

3.5 Cable Bends

A. Radius or bends not less than ten times the outer diameter of the cable.

3.6 Conductor Pull

A. Conductors shall not be pulled into conduits until after all plastering or concrete work is completed and all conduits in which moisture collected have been swabbed out.

3.7 Feeder Identification

A. Tag feeder circuits in each enclosure with wrap around circuit designation labels.

3.8 Connectors and Lugs

A. Install with manufacturer's recommended tools and with the type and quantity of deformations recommended by manufacturer.

3.9 Bundling

A. Conductors No. 10 and smaller shall be neatly and securely bundled and conductors larger than No. 10 shall be neatly and securely cabled in individual circuits, utilizing marlin twine, two ply lacing or nylon straps.

END OF SECTION

SECTION 26 05 33.13

CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 Related Work Specified Elsewhere

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. 26 05 00 Common Work Results for Electrical

C. 26 05 26 Grounding and Bonding for Electrical Systems

PART 2 PRODUCTS

2.1 Conduits

A. Rigid Steel Conduit: Rigid, threaded, thick wall with zinc coated on the inside and either zinc coated or coated with an approved corrosion resistant coating on the outside.

B. Rigid Aluminum Conduit: Rigid, threaded, thick wall type, approved for the application.

C. Intermediate Metal Conduit (IMC): Rigid, threaded, lightweight steel, zinc coated or coated on the outside and either zinc coated or coated with an approved corrosion resistant coating on the inside.

D. Rigid Non Metallic Conduit: Schedule 80, high impact PVC with 7,000 psi tensile strength at 73.4°F, 11,000 psi flexural strength, 8,600 psi compression strength, approved 90 degree conductors. Carlon, Triangle or approved equal.

E. Electrical Metallic Tubing (EMT): Mild steel, zinc coated on the outside and either zinc coated or coated with an approved corrosion resistant coating on the inside.

F. Flexible Conduit: Commercial Greenfield, galvanized steel, with a separate grounding bond wire installed in the conduit in addition to other wires.

G. Liquid Tight Flexible Conduit: Flexible galvanized steel tubing with extruded liquid tight PVC outer jacket and a separate grounding conductor installed in the conduit.

H. Conduit Size: Minimum conduit size ½-inch except where specifically approved for equipment connections. Sizes not noted on the Drawings shall be as required by the NEC.

2.2 Conduit Fittings

A. Rigid Steel Conduit, IMC and EMT Fittings: Iron, steel, or die-cast only.

B. Rigid Aluminum Conduit Fittings: Malleable iron, steel or aluminum alloy. Ferrous fittings zinc coated or cadmium plated. Aluminum alloy fittings shall conform to the characteristics defined by UL for rigid aluminum metallic conduit and shall not contain more than 0.04 percent copper.

C. Rigid Non-metallic Conduit Fittings: Approved for the purpose and as recommended by the manufacturer.

D. Flexible Conduit Fittings (Commercial Greenfield): Either die-cast, steel, or malleable iron only with insulated throats and shall be of one of the following types:
1. Squeeze or clamp type with bearing surface contoured to wrap around the conduit and clamped by one or more screws.
2. Steel, multiple point type, for threading into internal wall of the conduit convolutions.
3. Wedge and screw type with angular in-edge fitting between the convolutions of the conduit.

E. Liquid tight Flexible Conduit Fittings: With threaded grounding cone, a steel, nylon, or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without “O” ring seal.

F. Connectors and Couplings: Compression type threadless fittings for rigid steel conduit or IMC not permitted. Set-screw type fittings for rigid aluminum conduit not permitted. EMT couplings and connectors either die-cast, steel, or malleable iron only, “Concrete tight” or “Raintight,” and either the gland and ring compression type or the stainless steel multiple point locking type. Connectors to have insulated throats. EMT fittings using set-screws or indentations as a means of attachment are not permitted.

G. Bushings: Insulated type, designed to prevent abrasion of the wires without impairing the continuity of the conduit grounding system, for rigid steel conduit, IMC, and rigid aluminum conduit.

H. Expansion Fittings: Each conduit that is buried in or rigidly secured to the building construction on opposite sides of a building expansion joint and each run of 100 feet of exposed conduit shall be provided with an expansion fitting. Expansion fittings shall be hot dipped galvanized malleable iron with factory-installed packing and a grounding ring.

I. Sealing Fittings: Threaded, zinc or cadmium coated, cast or malleable iron type for steel conduits and threaded cast aluminum type for aluminum conduits. Fittings used to prevent passage of water vapor shall be of the continuous drain type.

PART 3 EXECUTION

3.1 Conduit Installation

A. Conduit Systems: Rigid steel conduit, IMC, rigid non-metallic conduit or EMT unless otherwise specified.

B. Aluminum Conduit: Aluminum conduit may be used only in dry locations above ground in sizes 2-inch or larger for Power and Communications Systems.

C. Rigid Non-metallic Conduit: Install in accordance with manufacturer's recommendations. Joints shall be solvent welded. Field bends shall utilize approved bending equipment. Provide rigid steel elbows and rigid steel conduit risers on underground runs or runs in concrete. Provide a suitable bond wire in each run except low voltage communications runs. Underground runs under concrete slabs may be direct buried without concrete encasement if of approved type. Rigid non-metallic conduit may be installed outside the perimeter of the building. Rigid non-metallic conduit is not permitted to be surface mounted in ducts, plenums or other air handling spaces. All 90 degree bends shall be rigid steel conduit. For encased conduits carrying 600 volts or more, the concrete shall be colored red using a permanent dye.

D. EMT: Not permitted underground or embedded in concrete.

E. Flexible Conduits: Use flexible conduit only for motor or equipment connections and then only to the extent of minimum lengths required for connections. Length shall not exceed 5 feet without approval from the Owners Representative and Owner. Install flexible conduit connections at all resilient mounted equipment. Provide liquid tight flexible conduit in exterior, wet or damp locations and for connections to wet pipe mechanical systems.

F. Conduit in Concrete: Rigid steel conduit or rigid non-metallic conduit may not be embedded in concrete that is in direct contact with the earth. When embedded, the outside diameter shall not exceed one-third the thickness of the concrete slab, wall or beam, shall be located entirely within the center third of the member, and the lateral spacing of conduits shall not be less than three diameter unless otherwise prohibited by Owners Representative.

G. Steel Conduit in Ground: Rigid steel conduit that is not completely encased in concrete but is in contact with ground or on a vapor barrier shall be wrapped with Scotchwrap 51 half lapped, or shall have an additional outside factory coating of PVC with a minimum coat thickness of 20 mils. Other PVC or Phenolic resin epoxy coating material that is equally flexible and chemically resistant may be used providing approval by the Owner's Representative is obtained prior to the installation.

H. Exposed Conduits: Install exposed conduit systems parallel to or at right angles to the lines of the building. Right angle bends in exposed runs shall be made with standard elbows, screw jointed conduit fittings or conduit bent to radii not less than those of standard elbows.

I. Concealed Conduits: Install conduit systems concealed unless otherwise noted. Conduit systems may be exposed in unfinished utility areas, ceiling cavities, and where specifically approved by the Owners Representative. Install concealed conduit systems in as direct lines as possible.

J. Conduit Openings: Protect all vertical runs of conduits or EMT terminating in the bottoms of boxes or cabinets, etc., from the entrance of foreign material prior to installation of conductors.

K. Sealing Fittings: Install where required by the NEC, where conduits pass from warm to cold locations and where otherwise indicated.

L. Sleeves for Conduit: Install sleeves for conduit where shown or as required. Conduit sleeves not used shall be plugged with recessed type plugs. Sleeve all conduit passing through walls. Sleeves that are used shall be sealed tight with rated fire and smokeproofing compounds.

3.2 Conduit Supports

A. Supports: Provide supports for horizontal steel conduits and EMT not more than 8 feet apart with one support near each elbow or bend and one support within 1 foot of each coupling, including runs above suspended ceilings.

B. Straps: Install one hole pipe straps on conduits 1½ inch or smaller. Install individual pipe hangers for conduits larger than 1½ inch. Spring steel fasteners with hanger rods may be used in dry locations in lieu of pipe straps.

C. Hanger Rods: Install ¼-inch-diameter or larger steel rods for trapezes, spring steel fasteners, clips and clamps. Wire or perforated strapping shall not be used for the support of any conduit or EMT.

D. Fastening: Fasten pipe straps and hanger rods to concrete by means of inserts or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry by means of toggle bolts. Wooden plugs and shields shall not be used. Power driven fasteners may be used to attach pipe straps and hanger rods to concrete where approved by the Owners Representative. All conduits not embedded in concrete shall be firmly secured by means of pipe clamps, hangers, etc., equal to Caddy Fasteners of ERICO Products, Inc., or approved equal. Wire wrapped around conduits and supporting members will not be accepted. Conduit fastened to the wall above the ceiling is not acceptable.

3.3 Identification

A. Identify per Section 26-0553.

3.4 Closing of Opening

A. Wherever slots, sleeves or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, including bus ducts, such openings, if unused, or

the spaces left in such openings, shall be closed. All closure material along with installation methods shall retain the fire rating integrity of the surface being penetrated. All openings in walls or floors remaining after removal of existing conduits, raceways, or bus ducts shall be closed in a like, approved manner.

END OF SECTION

SECTION 26 05 33.16

BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 Related Work Specified Elsewhere

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. 26 05 00 Common Work Results for Electrical

C. 26 05 26 Grounding and Bonding for Electrical Systems

PART 2 PRODUCTS

2.1 Outlet Boxes

A. Construction: Zinc coated or cadmium plated sheet steel boxes of a class to satisfy the conditions at each outlet except where unilet or condulet bodies are required. Knockout type with knockouts removed are required. Knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight sided gang boxes, 4-inch octagon concrete rings and 4-inch octagon hung ceiling boxes with bars may be folded type; one piece deep drawn for all other boxes.

B. Size: To accommodate the required number and sizes of conduits, wires and splices in accordance with NEC requirements, but not smaller than size shown or specified. Standard concrete type boxes not to exceed six inches deep except where necessary to permit entrance of conduits into sides of boxes without interference with reinforcing bars. Special purpose boxes shall be sized for the device or application indicated.

C. Exposed: Screw joint type with gasketed weatherproof covers in locations exposed to the weather.

D. Wall Mounted Switch, Receptacle and Signal Boxes: Unless otherwise noted or specified not less 4-inch square by 1½ inch deep for 2 devices and multi gang boxes for more than 2 devices. Boxes for switches and receptacles on unfinished walls may be screw joint type with covers to fit the devices.

E. Grounding Terminal: Provide a grounding terminal in each box containing a green equipment ground conductor or serving motors or receptacles. Grounding terminal shall be green colored washer in head machine screw or grounding bushing.

2.2 Pullboxes

A. Minimum NEC requirements unless larger box is noted. As specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches. As specified for cabinets or pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion resistant screw or bolt attachment.

PART 3 EXECUTION

3.1 Outlet Boxes

A. Mounting Heights: The mounting height of a wall mounted outlet box shall be construed to mean the height from the finished floor to the horizontal centerline of the cover plate. On exposed tile, block or brick construction, mount outlet boxes at the nearest bed joint to the mounting height indicated. The height of all outlets shall be at the same height when there is a secondary type wall construction along with the masonry construction. The height in the masonry construction shall be the governing factor.

3.2 Pullboxes

A. Provide additional pullboxes wherever necessary to meet requirements for maximum lengths of conduit runs and maximum numbers of bends as specified under “Conduit and Fittings.”

3.3 Identification

A. Identify all exposed junction and pullboxes according to the system carried by means of painted on stencils or labels with legible letters and contrasting colors without abbreviations. In general, use yellow color. Painting shall be in accordance with Division 9, Finishes.

END OF SECTION

SECTION 26 05 53

ELECTRICAL IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 Related Documents

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

1.2 Summary

A. This Section includes the following:
1. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 Quality Assurance

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.4 Coordination

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 Raceway and Metal-Clad Cable Identification Materials

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:
1. Power Circuits: Black letters on an orange field.
2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 Conductor, Communication, and Control Cable Identification Materials

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 Underground-Line Warning Tape

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 Warning Labels and Signs

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 Instruction Signs

A. Engraved, laminated acrylic or melamine plastic, minimum $^{1}/_{16}$ inch thick for signs up to 20 square inches and ⅛ inch thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 Equipment Identification Labels

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be ⅜ inch.

B. Outdoor Equipment Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.7 Miscellaneous Identification Products

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
   1. Minimum Width: $^{3}/_{16}$ inch.
   2. Tensile Strength: 50 lb minimum.
   3. Temperature Range: –40 to +185°F.
   4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.8 Wiring Device Identification

A. Description: Self-adhesive label with black upper case letters on clear polyester label, font size

PART 3 EXECUTION

3.1 Application

A. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders More Than 400 A: Identify with orange self-adhesive vinyl label.

C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color coded, self-adhesive vinyl tape applied in bands:
   1. Fire Alarm System: Red.
   2. Security System: Blue and yellow.
   3. Telecommunication System: Green and yellow.
   4. Control Wiring: Green and red.

D. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

E. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.

F. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.

G. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
   1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.
   2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

K. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
   a. Indoor Equipment: Engraved, laminated acrylic or melamine label mechanically secured.
   b. Outdoor Equipment: Stenciled.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
2. Equipment to Be Labeled: If included on project. All items may not be on project.
   a. Panelboards, electrical cabinets, and enclosures.
   b. Access doors and panels for concealed electrical items.
   c. Electrical switchgear and switchboards.
   d. Transformers.
   e. Disconnect switches.
   f. Motor starters.
   g. Contactors.

M. Wiring Device Identification Labels: On each faceplate install circuit designation label that is consistent with panelboard directories, and as-built plan drawings. Apply labels to receptacle faceplates centered below bottom outlet. Apply labels to toggle switch faceplates on backside.

3.2 Installation

A. Verify identity of each item before installing identification products.

B. Location:
1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
2. Conduit Markers: Provide identification for each power conduit.

C. Apply identification devices to surfaces after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
   d. Neutral White
3. Colors for 480/277-V Circuits:
   a. Phase A: Brown
   b. Phase B: Orange
   c. Phase C: Yellow
   d. Neutral Gray
4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

I. Label information arrangement for 3 lines of text.
1. Line one shall describe the panel or equipment. Line one example: “DP-XX,” RP-XX,” “T-XX,” “EF-XX,” etc.
2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: “Fed from DP-XX,” “Fed from RP-XX,” etc
3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: “First Floor Elect. Rm #XXX.”
4. Line four shall include “Via T-XX” when panel or equipment is fed from a transformer.

J. Examples:
1. RP-1A
   FED FROM DP-1A
   ELECTRICAL ROOM A100
   VIA T-1A

2. EF-1
FED FROM MCC-1A
MECHANICAL ROOM F101
LP-1A LOCATED IN ELECTRICAL ROOM A100

K. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.

L. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

M. Degrease and clean surface to receive nameplates.

N. Install nameplate and labels parallel to equipment lines.

O. Secure nameplate to equipment front using screws.

P. Secure nameplate to inside surface of door on panel board that is recessed in finished locations.

Q. Identify conduit using field painting where required.

R. Paint red colored band on each fire alarm conduit and junction box.

S. Paint bands 10 feet on center, and 4 inches minimum in width.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 Related Work Specified Elsewhere

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any), and General Requirements apply to the work specified in this section.

B. 26 05 00 Common Work Results for Electrical

C. 26 05 19 Low-Voltage Electrical Conductors and Cables

D. 26 05 33.13 Conduit for Electrical Systems

E. 26 05 33.16 Boxes for Electrical Systems

F. 26 27 16 Electrical Cabinets and Enclosures

G. 26 27 26 Wiring Devices

PART 2 PRODUCTS

2.1 Materials, equipment, and devices related to the grounding system are specified under other sections of these Specifications.

PART 3 EXECUTION

3.1 General

A. Install two separate grounding systems, a service grounding system and an equipment grounding system. The service equipment, conduit systems, supports, cabinets, equipment, and neutral conductor shall be grounded in accordance with the minimum code requirements and as further indicated on the Drawings or as specified. Connect the two grounding systems together only at the main service equipment and at the secondary terminals of transformers creating separately derived distribution systems such as dry type transformers.

3.2 Equipment Grounding System

A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the Drawings or specified. The equipment ground (green conductor) consists of metallic connections to ground of non-

current-carrying metal parts of the wiring system or apparatus connected to the system. The primary purpose of equipment grounding is to provide greater safety by limiting the electrical potential between non-current-carrying parts of the system and to provide a low impedance path to ground for possible ground fault currents.

B. Common Ground Point: Establish one common ground point as specified elsewhere in this section of the specifications for interconnection of the equipment grounding system and the service grounding electrode conductor.

C. Service Equipment Enclosure: Bond the enclosure of the main service equipment to the uninsulated equipment ground box (or bar) with a conductor or bar sized for 50% of the largest service overcurrent device.

D. Ground Bar: Provide an uninsulated equipment ground bar, separate from any insulated neutral bar, in all panelboards, starters, disconnect switches, cabinets, etc. for grounding the enclosure and for connecting other equipment ground conductors. The ground bar shall be an integrally mounted and braced bus bar in panelboards or a separately mounted bar adequately braced or bolted to the enclosure after thoroughly cleaning both surfaces to assure good contact. Provide solderless pressure connectors for all conductor terminations. Number and size of pressure connectors on equipment grounding bars as required for the termination of equipment grounding conductors. In addition to the active circuits, provide pressure connectors for all three phase spares and spaces.

E. Conduits: Where metallic conduits terminate without mechanical connection to a metallic housing of electrical equipment by means of lock nut and bushings, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Metallic conduits containing ground wiring only shall be bonded to the ground wire at both conduit entrance and exit. Install grounding conductor in each nonmetallic conduit or duct except those used for telephone, sound, or low voltage signals and in all flexible conduit that does not have a built in ground conductor. Bond the conductor at both ends to the equipment grounding system.

F. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three phase feeder and each branch circuit with a three phase protective device. Provide a separate green insulated equipment grounding conductor for single phase branch circuits where indicated on the Drawings. Install the required grounding conductor in the common conduit or raceway with the related phase and/or neutral conductors and connect to the box or cabinet grounding terminal. Where there are parallel feeders installed in more than one raceway each raceway shall have a green insulated equipment ground conductor installed.

G. Devices: Install a minimum No. 12 green insulated equipment bonding conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles and through flexible conduit to all light fixture housings and other fixed equipment.

H. Motors: Install a separate green insulated equipment grounding conductor from the equipment ground bar in the motor control center or separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor.

Install the grounding conductor in the common conduit or raceway with the related motor circuit conductors.

3.3 Grounding Conductors

A. The grounding conductors for both service ground electrodes shall be insulated or bare copper, sized in accordance with NEC 250 94, including the conductor for the made electrode. The conductors shall be continuous without joint or splice and shall be installed in conduit with the conduit bonded to the conductor at each end. Install the conductor to permit the shortest and the most direct path and terminate in the main service equipment on the common ground point. Equipment grounding conductors shall be green insulated conductors equivalent to the insulation on the associated phase conductor, but not less than Type TW. The equipment grounding conductor or straps shall be sized in accordance with NEC. Where one feeder serves a series of panelboards of transformers the equipment grounding conductor shall be continuous without splices. Grounding conductors shall not be installed through metal sheathed holes. All connections shall be available for inspection and maintenance.

3.4 Ground Connections

A. Clean surfaces thoroughly before applying ground lugs or clamps. If surface is coated the coating must be removed down to the bare metal. After the coating has been removed apply a non-corrosive approved compound to cleaned surface and install lugs or clamps. Where galvanizing is removed from metal it shall be painted or touched up with “Galvanoz,” or equal.

3.5 Tests

A. Remove all jumpers between the equipment ground busses and the service (neutral) ground busses in the main service panel and all separately derived systems. See Section 3.2.C.

B. For each grounding system, using a megger, measure the resistance between the two ground busses at the panel where the jumper was installed. The resistance shall be greater than 10 megohms.

C. Reconnect the equipment and service bus jumpers on all systems. See Section 3. 2.C.

D. For each grounding system, using a megger, measure the resistance between the two ground busses at the panel farthest away (electrically) from the panel where the jumper was installed. The resistance shall be less than 5 ohms.

E. Submit a written report to the Engineer for approval. The service shall not be energized if the test shows more than 5 ohms, unless approved by the Owner’s Representative.

END OF SECTION

SECTION 26 27 16

ELECTRICAL CABINETS AND ENCLOSURES

PART 1 GENERAL

1.1 Related Work Specified Elsewhere

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any), and General Requirements apply to the work specified in this section.

B. 26 05 00 Common Work Results for Electrical

C. 26 05 26 Grounding and Bonding for Electrical Systems

PART 2 PRODUCTS

2.1 General

A. Sheet steel except those exposed to wet or rain conditions that shall be raintight unless otherwise noted. Cabinets without through feeder wiring shall be arranged to provide a wiring gutter not less than 4 inches wide for branch circuit panelboards served by feeders up to 4/0. Panelboards served by feeders in excess of 4/0, up to and including 750 MCM, shall be provided with top, bottom and side gutters 8 inches wide. Panelboard cabinets in all cases shall meet or exceed the minimum requirements of Article 373 6 of the National Electrical Code. Cabinets shall be of standard make and shall be equal in all respects to those bearing the Underwriters Laboratories label. Cabinets, including boxes shall be made of galvanized steel. All outside surfaces of trim and doors shall be given a factory finish coat of No. 61 ANSI gray paint, or approved manufacturer's standard. Cabinet for telephone and communications systems shall have ⅝ inch exterior grade, one face B grade or equal plywood backboard inside with maximum height and width.

2.2 Feed Through Gutters

A. Where feeders go through panelboard cabinets to serve panelboards above or beyond, the wiring gutters in panelboard cabinets shall be a minimum of 8 inches on sides, top, and bottom.

2.3 Fronts

A. One piece sheet steel frame and a hinged door with catch and lock for flush cabinets. Telephone and signal cabinets for surface mounting shall be equipped with a door hinged directly to cabinet. One piece sheet steel with ¾-inch flange with all edges shaped to cover edge of box. Fronts may be secured to box by means of flathead screws with captive nuts or clamps.

2.4 Doors

A. Doors shall close against a rabbet placed all around the inside edge of the frame with a close fitting joint between door and frame. The doors shall be fitted with substantial flush hinges placed not over 24 inches apart and not more than 6 inches from ends of doors, and fastened permanently to the door and frame with flat headed rivets or spot welds, or with concealed flush piano hinges. Fastening screws of fronts shall be set not over 24 inches apart. Doors over 48 inches in height shall be equipped with a vault hinge and a three point catch.

2.5 Door-In-Door

A. Both surface and flush cabinets shall be door-in-door. The door over the interior of the cabinet shall be provided with hinges and combined lock and latch. The outside door over the cabinet gutters shall have a hinge on one side, and machine screws into threaded holes in the cabinet on the other three sides. In order to insure the rigidity of the outside door, surface type cabinets shall have a ½ inch deep lip bent over all around, with the corners welded and grounded; or in the case of flush cabinets, a steel angle frame, equivalent in strength to the bent over lip, shall be welded to the inside of the door. The outside door shall be of such size as to allow a minimum of 2¾ inch opening to all four sides of the wiring gutter. All locks shall be keyed alike.

2.6 Locks

A. Furnish each cabinet with a combination catch and flat key lock. The telephone, electrical and signal cabinet locks shall be fitted to separate keying for each system. Furnish two keys for each cabinet.

2.7 Ground Bar

A. Each cabinet for a panelboard shall be provided with a copper interior ground bar suitably braced or bolted to the cabinet wall. The equipment ground bar shall be equivalent in current carrying pressure connector terminations for the associated feeders, branch circuits, etc.

PART 3 EXECUTION

3.1 Cabinets

A. Cables installed in the wiring gutters of cabinets shall be neatly bundled, routed and supported. Minimum bending radii as recommended by the cable manufacturer shall not be reduced. Lighting and power cabinets shall be installed with tops 6 feet 6 inches above floor and bottoms not less than 12 inches above floor. The height above floor of the highest over current device handle shall not exceed 6 feet 6 inches.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 Related Work Specified Elsewhere

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any), and General Requirements apply to the work specified in this section.

B. 26 05 00 Common Work Results for Electrical

C. 26 05 26 Grounding and Bonding for Electrical Systems

PART 2 PRODUCTS

2.1 Receptacles

A. General: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publication WDI 1965, Part 3 and Part 10. Single or duplex as shown or noted on Drawings. Ivory color unless otherwise noted on the drawings. Double grip contacts for each prong.

B. Grounding Type: All receptacles shall be grounding type with a green colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper (based on Table 250 95 of the NEC with minimum size No. 14 AWG). Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke.

C. Unless otherwise noted, receptacles shall be as follows:

Type	Hubbell	Bryant	P&S
Spec. Grade Duplex - 20 amp	5362-I	5362-I	5362-I
GFCI, Spec. Grade Duplex - 20 amp	GF-5362-I	GFR53FT-I	2091-FI

D. Special: Receptacles for special applications shall be as indicated on the Drawings.

2.2 Plug Caps

A. Except for duplex receptacles and cleaning combination receptacles one matching plug cap shall be provided for each receptacle. No plug caps are required for duplex receptacles.

2.3 Device Plates

A. General: Provide device plates for each switch, receptacle, signal and telephone outlet and special purpose outlet. Do not use sectional gang plates. Provide multi gang outlet plates for multi gang boxes. Plates shall be Stainless Steel unless otherwise noted.

B. Exposed: Plates for exposed joint fittings shall match the fittings with edges of plates flush with edges of fittings. Heavy cadmium steel plates with gasket. Plates for cast type boxes at locations subject to wet or rain conditions shall be of cast, vapor tight type. Provide hinged lift covers for devices.

C. Plates for special purpose outlets shall be of a design suitable for the particular applications.

PART 3 EXECUTION

3.1 Device Plates

A. Install with alignment tolerance of $^{1}/_{16}$ inch and all edges in continuous contact with wall surfaces.

END OF SECTION

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 Summary

A. This section includes requirements for the clearing and grubbing of areas as shown on the Drawings.

1.2 Definitions

A. Definitions include:
1. Clearing is the removal from the ground surface and disposal of trees, brush, shrubs, down timber, decayed wood, other vegetation, concrete, rubbish, and debris, as well as the removal of fences, stockpiled materials, and incidental structures.
2. Grubbing is the removal and disposal of all stumps, buried logs, roots, matted roots, and organic materials.

PART 2 MATERIALS

Not used

PART 3 EXECUTION

3.1 Disposition of Trees and Shrubs

A. General
1. Trees and shrubs within the limits of work shall be removed where shown on the Drawings. Do not cut or damage trees unless so indicated or unless written permission has been obtained from the affected property owner. Three copies of such permission shall be furnished to the Engineer before removal operations commence.

B. Trees and Shrubs to be Removed
1. Trees and shrubs felled within the limits of work shall have their stumps grubbed and removed to a licensed disposal site. Depressions created by such removal shall be filled with structural backfill.

3.2 Clearing and Grubbing

A. Clear all items specified herein to the limits indicated and stockpile cleared and grubbed material on-site. Do not start earthwork operations in areas where clearing and grubbing is not complete, except that stumps and large roots may be removed concurrent with

excavation. Comply with erosion and sediment control and stormwater management measures. Super silt fence shall be installed prior to earth-moving activities.

B. Clear and grub areas to be excavated, areas to receive fill, and areas upon which structures are to be constructed. Remove all trees, stumps, and root mats in these areas and dispose of them offsite at no cost to the property owner. Depressions made by the removal of stumps or roots shall be filled with suitable backfill.

C. The Contractor shall clear, grub, and strip the site area to the limits of disturbance shown on the Contract Drawings. Clearing and grubbing shall not be performed more than 60 days before excavation is to begin.

END OF SECTION

SECTION 31 23 16

EXCAVATION AND FILL

PART 1 GENERAL

1.1 Summary

A. Section Includes:
   1. Guidance on excavation and fill of foundations and trenches.
   2. This Section shall be supplemental to 701 of the New Mexico Standard Specifications for Public Works Construction. Section 701 shall apply except as modified in this Section.

B. Related Sections:
   1. Section 01 89 13 Site Preparation
   2. Section 33 14 00 Water Utilities

1.2 References

A. New Mexico Standard Specifications for Public Works Construction:
   1. Section 701 - Trenching, Excavation and Backfill

1.3 Definitions

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Trench Zone: The trench zone includes the portion of the trench from the top of the pipe zone to the existing surface in unpaved areas.

C. Pipe Zone: The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level 12 inches above the top of the pipe. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipes to a horizontal level 12 inches above the top of the highest or topmost pipe.

D. Pipe Bedding: The pipe bedding shall be defined as a layer of material immediately below the bottom of the pipe or conduit and extending over the full trench width in which the pipe is bedded. Thickness of pipe bedding shall be as shown on the drawings or as described in these specifications.

E. Excess Excavated Material
   1. The Contractor shall make the necessary arrangements for and shall remove and dispose of all excess excavated material.
   2. No excavated material shall be deposited on private property unless written permission from the Engineer is secured by the Contractor.

1.4 Trench Safety

A. All excavations shall be performed, protected, and supported as required for safety. In all cases, Contractor shall ensure that all excavation and trenching methods meet or exceed safety requirements as set forth by local, state, and federal agencies.

B. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all traffic of such excavations.

C. No trench or excavation shall remain open and exposed to vehicular or foot traffic during non-working hours. The trench or excavation shall be fenced off, or covered with steel plates, spiked in place, or backfilled.

D. The Contractor shall notify the Engineer of all work-related accidents which may occur to persons or property at or near the project site, and shall provide the Engineer with a copy of all accident reports. All accident reports shall be signed by the Contractor or its authorized representative and submitted to the Engineer within 24 hours of the accident's occurrence.

1.5 Access

A. Unobstructed access must be provided to all driveways or other property or facilities that require routine use. Temporary closures of driveways require written approval of the property owner and confirmation from the Engineer.

1.6 Permits

A. The Contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

1.7 Quality Assurance

A. Perform Work in accordance with applicable State of New Mexico Standard Specifications for Public Works Construction.

1.8 Coordination

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 Fill Materials

A. Native Earth Backfill: Native earth backfill, acceptable for use, shall be fine-grained material free from roots, debris, and rocks with a maximum dimension not larger than 3 inches.

B. Imported Backfill Material: Whenever the excavated material is not suitable for backfill, the Contractor shall arrange for and furnish suitable imported backfill material that is capable of attaining the required relative density.

C. Structural Backfill: Shall be placed under the booster station, welded steel tank, engine-generator pad, pump vault, and wastewater treatment container, and shall meet the requirements outlined in the geotechnical report.

D. The Contractor shall dispose of the excess trench excavation material as specified in the preceding section. Backfilling with imported material shall be done in accordance with the methods described herein.

PART 3 EXECUTION

3.1 Compaction Requirements

A. Determine the density of soil in place by the use of a nuclear testing gauge.

B. Determine laboratory moisture-density relations of existing soils by ASTM D698.

C. Determine the relative density of cohesionless soils by ASTM D2049.

D. Sample backfill materials by ASTM D75.

E. Express “relative compaction” as the ratio, expressed as a percentage; of the in place dry density to the laboratory maximum dry density.

F. Compaction shall be deemed to comply with the specifications when no test falls below the specified relative compaction.

G. The Contractor will secure the services of a soils tester and pay the costs of all compaction testing. The Contractor will be responsible for the cost of all retests in failed areas. Test results will be furnished to the Engineer immediately upon conclusion of the test.

H. If the backfill fails to meet the specified relative compaction requirements, the Contractor shall rework the backfill until the requirements are met. The Contractor shall make all necessary excavations for density tests as directed by the Engineer. The Contractor will be responsible for the cost of all additional compaction tests in the reworked areas.

I. Compaction tests shall be performed at 2-foot depths and at 200-foot intervals in accordance with ASTM D2922 and D3017.

J. Unless otherwise shown on the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as described below:
   1. Pipe zone and pipe base: 95% relative compaction.
   2. Trench zone not beneath paving: 95% relative compaction.

3. Work performed in roadways shall be done in accordance with Section A-1 of Standard Specification 701 and approval of the roadway Owner.

3.2 Material Replacement

A. Removal and replacement of any trench and backfill material which does not meet the specifications shall be the Contractor's responsibility.

3.3 Trenching

A. Excavation for pipe, fittings, and appurtenances shall be open trench to the depth and in the direction necessary for the proper installation of the facilities as shown on the plans.

B. Trench banks shall be kept as near to vertical as possible and shall be properly braced and sheeted.

3.4 Bracing

A. The Contractor's design and installation of bracing and shoring shall be consistent with OSHA rules, orders, and regulations.

B. Excavations shall be braced, sheeted, and supported so that they will be safe such that the walls of the excavation will not slide or settle and all existing improvements of any kind, either on public or private property, will be fully protected from damage.

C. The sheeting, shoring, and bracing shall be arranged so as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength.

D. Care shall be exercised in the drawing or removal of sheeting, shoring, bracing, and timbering to prevent the caving or collapse of the excavation faces being supported.

3.5 Trench Widths

A. Excavation and trenching shall be true to line with a minimum width of the largest outside diameter of the pipe + 12 inches and a maximum width of the largest outside diameter of the pipe + 24 inches. Width of trenches for multiple pipes will keep a distance of 12 inches between pipes.

3.6 Length of Open Trench

A. The maximum allowable length of open trench shall be the distance necessary to accommodate the amount of pipe installed in a single day.

3.7 Grade

A. Excavate the trench to the lines and grades shown on the Drawings with allowance for pipe thickness and for pipe base or special bedding.

B. The trench bottom shall be graded to provide a smooth, firm, and stable foundation that is free from rocks and other obstructions and shall be at a reasonably uniform grade.

3.8 Correction of Overexcavation

A. Where excavation is inadvertently carried below the design trench depth, suitable provision shall be made by the Contractor to adjust the excavation, as directed by the Engineer, to meet requirements incurred by the deeper excavation.

B. Over excavations shall be corrected by backfilling with approved graded crushed rock or gravel and shall be compacted to provide a firm and unyielding subgrade or foundation, as directed by the Engineer.

3.9 Foundation Stabilization

A. Whenever the trench bottom does not afford a sufficiently solid and stable base to support the pipe or appurtenances, the Contractor shall excavate to a depth below the design trench bottom, as directed by the Engineer, and the trench bottom shall be backfilled with ¾-inch rock and compacted to provide uniform support and a firm foundation.

B. Where rock is encountered, (see Section 3.10 C) it shall be removed to a depth at least 6 inches below grade and the trench shall be backfilled with ¾-inch crushed rock to provide uniform support and a firm foundation.

C. If excessively wet, soft, spongy, unstable, or similarly unsuitable material is encountered at the surface upon which the bedding material is to be placed, the unsuitable material shall removed to a depth as determined in the field by the Engineer and replaced by crushed rock to provide uniform support and a firm foundation..

3.10 Excavated Material

A. All excavated material shall not be stockpiled in a manner that will create an unsafe work area or obstruct sidewalks or driveways.

B. In confined work areas, the Contractor may be required to stockpile the excavated material off-site, as determined by the Engineer.

C. Rock excavation is defined as boulders, sedimentary, or igneous rock that cannot be removed without continuous use of pneumatic tools or blasting.

3.11 Placing of Pipe Bedding

A. Place the thickness of pipe bedding material over the full width of trench necessary to produce the required bedding thickness when the material is compacted to the specified relative density. Grade the top of the pipe bedding ahead of the pipe to provide firm, uniform support along the full length of pipe. Pipe bedding to be free of rocks or deleterious materials which may come in contact with the pipe.

3.12 Backfilling Within Pipe Zone

A. After pipe has been installed in the trench, place pipe zone material simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.

3.13 Backfilling Within Trench Zone

A. Push the backfill material carefully onto the backfill previously placed in the pipe zone. Do not permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.

B. The remaining portion of the trench to the street zone or ground surface, as the case may be, shall be backfilled, compacted, and/or consolidated by approved methods to obtain the specified relative compaction.

1. Compaction using vibratory equipment, tamping rollers, pneumatic tire rollers, or other mechanical tampers shall be done with the type and size of equipment necessary to accomplish the work. The backfill shall be placed in horizontal layers of not greater than 12 inches depth. Each layer shall be evenly spread, properly moistened, and compacted to the specified relative density as given on the drawings. The Contractor shall repair or replace any utility, pipe, fittings, manholes, or structures as directed by the Engineer damaged by the Contractor's operations.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 Summary

A. The work for chain link fences and gates covered under this section consists of furnishing all equipment, labor, materials, and incidentals necessary for the complete installation of a chain link fence and accessories, in strict accordance with the applicable drawings, the provisions of ASTM F567 (active standard), and these Technical Provisions.

1.2 General

A. Fencing and gates shall be constructed to the dimensions shown and at the locations as shown on the drawings.

1.3 Submittals

A. General: Submit the following items.

B. Product Data: Submit product data for the following materials and items.
1. Fabric
2. Posts, post rails, and braces
3. Tension wire
4. Barbed wire
5. Chain link fence accessories
6. Gates and accessories
7. Cement mix for concrete
8. Privacy screen

PART 2 MATERIALS

A. Fence Fabric: Fence fabric shall be zinc coated steel fabric meeting the requirements of federal specifications RR-F-191/1C and ASTM A392. Fabric shall be woven in a 2-inch diamond mesh and of height specified on the drawings. The weight of zinc coating shall not be less than 1.2 oz/ft^2.
1. Wire used in 4-foot fence fabric shall be 11-gauge (0.120-inch diameter) and shall be knuckled on the top and bottom selvage.
2. Wire used in 6-foot and 8-foot fence fabric shall be 9-gauge (0.148-inch diameter) and shall be twisted on the top selvage and knuckled on the bottom selvage. Wire ends shall be cut at an angle.

B. Tension Wire: Tension wire shall have a marcelled pattern. The wire shall be zinc-coated, galvanized steel wire, 7-gauge (0.177-inch diameter), conforming to ASTM A824.

C. Barbed Wire: Barbed wire shall be zinc-coated steel barbed wire conforming to ASTM A121. The barbed wire shall be design number 12-4-5-14R: two twisted strands of 12-gauge wire, and 4-point, 14-gauge barbs spaced 5 inches on center.

D. Chain Link Fence Accessories: The following components shall be zinc-coated steel with a minimum zinc coating of 1.2 oz/ft^2, and galvanized after fabrication, conforming to ASTM F626. Any additional fence accessory not specifically stated shall also meet these requirements unless otherwise approved by the Owner or the Owner's representative.
   1. Post and line caps: Caps shall be designed to fit securely over the outside of the posts and be watertight.
   2. Rail and brace ends: No additional requirements.
   3. Tie wires, clips, and fasteners: No additional requirements. Hog rings shall be included in this category.
   4. Tension and brace bands: No additional requirements.
   5. Tension bars: Tension bars shall have a cross section no less than ¼ inch by ¾ inch. The tension bar shall be of a continuous length and not shorter than 2 inches less than the nominal height of the fabric.
   6. Truss rod assembly: The truss rod assembly shall consist of a steel rod not less than ⅜ inch in diameter and be equipped with a turnbuckle or other equivalent provision for adjustment. The assembly shall be capable of withstanding a tension of 2,000 lbs.
   7. Barbed wire arms: Barbed wire arms shall be designed to fit securely over the outside of the post while supporting horizontal braces and be watertight. Arms shall be at an angle of 45 degrees and shall be fitted with clips for attaching three strands of barbed wire. Barbed wire arms shall be of sufficient strength to withstand a weight of 250 pounds applied at the outer strand of the barbed wire.

E. Privacy Screen
   1. Polypropylene woven fabric, including 90% minimum sight blockage.
   2. Commercial grade to cover entire fenced area.
   3. Available colors shall be submitted for approval.

F. Posts, Post Rails and Braces: All pipe required for construction of the fence and gates shall be round Schedule 40 steel pipe, hot-dip galvanized (interior and exterior), zinc-coated, regular grade (30,000 psi) meeting or exceeding the requirements of ASTM F1083 and ASTM F1043 Group 1A.

Use	Nominal Pipe Size (inches)	Outside Diameter (inches)	Weight (lb/ft)	Fence Industry Trade Reference (inches)
Line Post				
4-foot fence	1½	1.900	2.72	1⅞
6- and 8-foot fence	2	2.375	3.65	2⅜
Brace rail, intermediate rail	1¼	1.660	2.27	1⅝
Gate Frames				
4-foot fence	1¼	1.660	2.27	1⅝
6- and 8-foot fence	1½	1.900	2.72	1⅞
Terminal, End, Corner & Slope/Pull Posts				
4-foot fence	2	2.375	3.65	2⅜
6- and 8-foot fence	2½	2.875	5.80	2⅞
Gate Posts				
4-foot Fence				
Gate leaf up to 4 feet	2	2.375	3.65	2⅜
Gate leaf over 4 feet to 10 feet	2½	2.875	5.80	2⅞
Gate leaf over 10 feet to 18 feet	3½	4.000	9.11	4
6- and 8-foot Fence				
Gate leaf up to 6 feet	2½	2.875	5.80	2⅞
Gate leaf over 6 feet to 12 feet	3½	4.000	9.11	4
Gate post sizes for gate leaf widths greater than listed shall be as directed by the Owner.				

G. Gates and Accessories: Swing gates, complete with latches, stops, keepers, hinges, drop bar, and barbed wire, shall be provided where shown on the plans. Swing gates shall conform to ASTM F900.

1. Gate Frames: Gate frames shall be Schedule 40 steel pipe as described in Section E of this specification.
2. Gate Fabric: The fabric shall be as specified for the fence as described in Section A of this specification.
3. All gate accessories shall be zinc-coated with a minimum zinc coating of 1.2 oz/ft^2, galvanized after fabrication, conforming to ASTM F626 and in accordance with tests set forth in ASTM A90.
4. Hinges: Gate Hinges shall be pressed steel or malleable iron. The hinges shall be designed to permit the gate to swing a full 180 degrees. The hinges shall be of adequate strength, with large bearing surfaces for clamping in position and shall not twist or turn under the action of the gate.
5. Latches: Double gate latches shall be a plunger bar arranged to engage the gate stop. Locking devices shall be constructed so that the plunger bar cannot be raised when the gate is locked. The latching device shall have provision for a

padlock and shall be designed such that both gate leaves can be locked with a single padlock. Single gate latches may be of the same style, or a forked latch may be provided. Each latch shall be provided with a padlock, Master or equal, and four keys.

6. Gate Stops: Gate stops shall be provided for all double gates and shall consist of a galvanized, hot-dipped zinc-coated Schedule 40 drop-bar and a receiving gate stop as illustrated on standard details of the construction drawings.
7. Keepers: Keepers shall be provided for each gate leaf 5 feet in width or more. Gate keepers shall consist of a mechanical device for securing the free end of the gate when in the fully open position.
8. Size of gates as indicated on drawings.

H. Concrete: Concrete shall be in conformance with Section 101 of the New Mexico Standard Specifications for Public Work Construction (2006) included with the technical provisions.

I. Warning Signs: Warning signs shall be prepared and erected to display the information/text/message as shown in the drawings. The size of the warning signs, number of warning signs, and the location of the warning signs shall be manufactured as shown on the construction drawings.

1. The signs shall be constructed of 16-gauge zinc coated steel or 0.105-inch aluminum sheeting. The letters shall be black on white background of a size approved by the Owner or Owner's Representative. The white background shall be hot sprayed with a weather-resistant, flexible enamel for enduring appearance. The letters shall be silk screened with sharp clear lines painted with a weather-resistant flexible enamel.
2. The signs shall be the product of a company regularly engaged in the manufacture of metal signs.

PART 3 EXECUTION

3.1 The fence shall be installed in accordance with ASTM F567 except as modified in these specifications.

A. Preparation: Prior to commencing all work, the Contractor shall locate all underground utilities and structures. The Contractor shall indicate the location and slope of fence lines, gates and terminal posts for actual construction by staking and shall secure the Owner's approval that such layout is in accordance with the plans. The Contractor shall clear and grade along the fence line only as necessary to provide a uniform clearance between the fence fabric and ground and permit proper installation. The Contractor shall remove existing fence at the work site as directed by the Owner or as indicated on the plans. All ground disturbances shall be filled to match existing grades.

B. Post Location: Line posts shall be spaced equidistantly at intervals not exceeding 10 feet. Terminal posts (end, corner, gate and slope/pull posts) shall be set where an abrupt change in alignment or grade of 30-degrees or more occurs or to divide straight runs of fencing which exceed 500 feet in length.

C. Post Setting: Set posts in concrete in holes of diameter and depth as shown in the tables below. Posts shall be set in a vertical position, plumb, in line and centered in the footing. Concrete shall be placed 6" below the post and shall extend 2 inches above grade and be crowned to shed water. Forms are not required. Fence fabric shall not be stretched until the concrete has cured for at least 7-days. If solid rock or concrete is encountered, the posts shall be set as recommended by the fencing manufacturer and approved by the Owner or Owner's Representative prior to installation.

1. 4-foot Fence Post Holes:

Type of Post	Diameter of Post Hole (inches)	Depth of Post Hole (inches)	Depth of Post in Concrete (inches)
Line Posts *(1.900-inch OD)*	8	24	18
Terminal Posts *(2.375-inch OD)*	10	24	18
Gate Posts			
Gate leaf less than 4 feet *(2.375-inch OD)*	10	36	30
Gate leaf between 4 and 10 feet *(2.875-inch OD)*	12	36	30
Gate leaf over 10 feet to 18 feet *(4.000-inch OD)*	16	36	30
Post holes for gate leafs greater than listed shall be as directed by the Owner.			

2. 6-foot and 8-foot Fence Post Holes:

Type of Post	Diameter of Post Hole (inches)	Depth of Post Hole (inches)	Depth of Post in Concrete (inches)
Line Posts *(2.375-inch OD)*	10	30	24
Terminal Posts *(2.875-inch OD)*	12	30	24
Gate Posts			
Gate leaf less than 6 feet *(2.875-inch OD)*	12	36	30
Gate leaf over 6 feet to 12 feet *(4.000-inch OD)*	16	3	30
Post holes for gate leafs greater than listed shall be as directed by the Owner.			

D. Post Caps: All posts shall be fitted with watertight caps. Barbed wire arms shall be installed on line posts to perform this function.

E. Top Rail and Bottom Tension Wire: The top rail shall be supported at each post so that a continuous brace from end-to-end of each stretch of fencing is formed. The top rail shall be securely fastened to the terminal posts and joined with sleeves or couplings. Bottom Tension wires are required and shall be fastened within the bottom 3 inches of the fence fabric. The tension wire shall be securely fastened to all terminal, gate and corner posts.

Securely fasten the tension wire to the terminal, corner and gate posts with a brace or stretcher bar band. The tension wire shall be taut and free of sag. After the fabric is stretched, fabric shall be attached to the bottom tension wire with C-rings (Hog-rings) at intervals not exceeding 12 inches. Fence fabric shall be secured to the top rails with tie wire at intervals not exceeding 18 inches.

F. Bracing: Bracing shall be provided for each terminal, corner and gate post consisting of a brace rail and truss rod assembly. Corner posts shall have bracing assemblies installed in both directions to the next line post. The brace rail shall be installed between the terminal, corner or gate post and the adjacent line post at two-thirds the height of the fabric. The truss rod assembly shall be installed from the bottom of the terminal, corner or gate post to the brace rail. The truss rod assembly shall be as shown on the plans and shall be finished neatly without undue protrusion of the ends.

G. G. Tension Bars: Tension bars shall be threaded through the fabric and attached to the terminal, corner or gate post by brace bands or tension bands at intervals not exceeding 12 inches. Terminal and gate posts shall have one tension bar installed. Corner posts shall have two tension bars installed.

H. Fence Fabric:
1. Install fence fabric on the outside of the fence and gate assembly framework.
2. Position the fence fabric 2 inches above ground level. Fasten the fabric to terminal, corner and gate posts with tension bars as specified. Cut the fabric and fasten each span independently at all terminal, corner and gate posts. Secure and apply sufficient tension to remove all slack and provide a smooth uniform appearance before making other attachments. Attach the fence fabric to the bottom tension wires with C-rings (hog rings) at intervals not exceeding 18 inches and to line posts with tie wires at intervals not exceeding 12 inches.
3. The fence fabric shall be cut by untwisting a picket and attaching each span independently to the terminal post as described. Where the fabric must be spliced, weave a single picket through the end links to form a continuous mesh and form the appropriate selvage at each end.

I. Barbed Wire: Where barbed wire is required, barbed wire shall be stretched taut to remove all sag and installed in the slots of the extension arms. Attach each strand of barbed wire to the terminal post using a brace band.

J. Summary of Fence Fabric Attachment points:

Fence Fabric Attachment to	Attach with	Attachment Spacing (inches)
Terminal Post	Brace Bands & Tension Bar	12
Line Post	Tie wire	
Corner Post	Brace Bands & Tension Bar	
Gate Frame Horizontal member	Tie wire	
Gate Frame Vertical member	Brace Bands & Tension Bar	
Tension Wire	Hog ring	18

K. Gates: Swing gates complete with latches, stops, keepers, hinges and barbed wire shall be provided where shown on the plans. Swing gates shall conform to ASTM F900 except as otherwise specified.

1. Frames shall be made of pipe as specified in Section E.
2. Frames shall be made with corner fittings or welding. Protect welds by applying a zinc-rich paint in accordance with ASTM A780 and the American Galvanizer Association such as Galvax Cold Galvanizing Paint (95% zinc) or an approved equal. Where corner fittings are used, gates shall have truss rod assemblies even if not otherwise stated. Gate leaf design shall be as stated below. Interior bracing shall be evenly spaced within the frame. Gate leaf sizes that are not encompassed by the following requirements shall be as noted on the plans or as directed by the Owner.
    a. 4-foot fabric gate leaf of 3 to 4 feet width shall have one diagonal truss rod assembly.
    b. 6- to 8-foot fabric gate leaf of 3 to 4 feet width shall have one horizontal brace.
    c. 6- to 8-foot fabric gate leaf of 5 to 8 feet width shall have one horizontal brace, one vertical brace and one diagonal truss rod assembly.
3. Where barbed wire is required, the end members of the gate frames shall extend one foot above the top horizontal member to which three strands of barbed wire, uniformly spaced, shall be attached by use of bands or clips.
4. Fabric shall be attached securely to the gate frame by tension bars, brace bands, and tie wires as specified for fence construction. All fence fabric attachments to gate framing is spaced a maximum of 12 inches.
5. Hinge and latch offset opening space from the gate frame to the gate post shall be no greater than 3 inches in the closed position.
6. Gate stops for double gates shall be set in a concrete footing of minimum 12 inches diameter and 24 inches deep.
7. The gate shall be capable of being opened and closed easily by one person and installed in a manner as to prevent removal of the gate by lifting off.
8. Gates shall swing or slide in the direction indicated in the drawings. Grade clearance and all possible gate obstructions shall be considered to provide adequate operational clearance. Gates shall be true to opening and plumb in a closed position.

L. Repairs to Coatings: Where galvanized coatings are cut, broken, burned, abraded, or otherwise damaged, affected areas shall be repaired by applying zinc-rich paint in accordance with ASTM Practice A780.

M. Cleanup:

1. The area of the fence installation shall be left neat and free of any debris caused by the erection of the fence.

END OF SECTION

SECTION 33 14 00

WATER UTILITIES

PART 1 GENERAL

1.1 Work Included

A. Pipes, materials, and appurtenances for potable water systems.

B. Installation

1.2 Related Work

A. Section 31 23 16 - Excavation and Fill

1.3 References

A. AWWA:
1. C110-12: Ductile-Iron and Gray-Iron Fittings 3" through 48" for water and other liquids.
2. C600-17: Installation of Ductile-Iron Water Mains and Their Appurtenances.
3. C651-14: Disinfecting Water Mains.
4. C700-20: Cold water meters - displacement type.
5. C900-22: AWWA Polyvinyl chloride (PVC) pressure pipe, 4 in. through 12 in. for water transmission and distribution
6. C901-20: Polyethylene (PE) Pressure Pipe and Tubing, 3/4 in. through 3 in. for Water Service
7. C906-15: Polyethylene (PE) Pressure Pipe and Fittings, 4 in. through 65 in. for Waterworks

B. ASTM:
1. A370-23: Mechanical Testing of steel products.
2. A536-84(2019)e1: Ductile iron castings.
3. D1330-04(2015)e1: Rubber sheet gaskets.
4. D1598-23: Test for time-of-failure of plastic pipe under long-term hydrostatic pressure.
5. D4976-12a(2020) - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
6. D2239-22 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR)
7. D2122-22 – Standard Test Method Determining Dimensions of Thermoplastic Pipe and Fittings.
8. D2239-22 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
9. D2241-20 Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
10. D2447-03 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter (Withdrawn without replacement)

11. D2513-20- Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
12. D2609-21 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
13. D2657-07(2023) - Standard Practice for Heat Fusion Joining Polyolefin Pipe and Fittings.
14. D2683-20 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
15. D2774-21a – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
16. D2837-22– Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Bases for Thermoplastic Pipe Products.
17. D3035-22 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
18. D3350-21 - Standard Specification for Polyethylene Plastics Pipe and Fitting Materials.
19. F412-23 - Standard Terminology Relating to Plastic Piping System.
20. F1248-96(2002)E1 - Standard Test Method for Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe. (Withdrawn 2007)
21. E8/E8M-22: Standard Method for Tension testing for metallic materials.

C. Plastic Pipe Institute (PPI):
1. Handbook of Polyethylene Pipe.
2. TR-33, Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.

1.4 Submittals

A. The following shall be submitted in conformance with Section 01 33 00.
1. Product Data (pipe sizes, materials and fittings)
2. Manufacturer’s installation instructions.
3. Manufacturer’s catalog information.

1.5 General Requirements

A. Pipes, fittings and materials to be new, of highest quality and shall be in excellent condition when installed.

B. Pipe, fittings, and appurtenances of the same type and made by the same manufacturer.

C. Provide labor, equipment, and materials for pipe field testing.

D. Contact and coordination with utility’s owner is the full responsibility of the Contractor.

1.6 Handling and Storage of Pipe and Appurtenances

A. Pipe, valves, and other appurtenances shall, unless otherwise directed, be unloaded, hauled and laid as follows:

1. Pipe and appurtenances shall be lifted by hoists with broad well-padded contact surfaces, or rolled on skidways in such a manner to avoid shock.
2. Under no circumstances shall pipe or appurtenances be dropped.
3. Pipe must not be rolled or skidded against pipe already on the ground.

B. The Contractor shall be responsible for the safe storage of material furnished by or to him and accepted by him, and intended for the work, until it has been installed in the completed project.

C. Installation:
1. In distributing material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
2. Pipe shall be handled in a manner that only a minimum amount of damage to the pipe exterior will result. Damaged piping shall be repaired in a manner satisfactory to the Engineer or replaced.
3. The interior of all pipe, fittings, and other appurtenances shall be kept free from dirt and foreign matter at all times.

1.7 Quality Assurance

A. Ductile Iron:
1. Tests:
a. ASTM E8: Tension Testing of Metallic Materials.
b. ASTM E23: Impact Test.
2. Marking: cast on each pipe length:
a. Weight, class, nominal thickness, and casting period.
b. Manufacturer’s name, year of production and the letters “DI” or the words “Ductile Iron.”

B. Valves:
1. Valves shall be built and equipped for the type of operation shown on the Plans or as directed by the Engineer.
2. All valves shall be of standard makes approved by the Engineer and shall have the name, monogram, or initials of the manufacturer cast thereon.

PART 2 PRODUCTS

2.1 Materials and Fabrication

A. Polyethylene Products
1. Manufacturers:
a. ISCO Industries.
b. Polypipe, Inc.
c. Performance Pipe, Inc.
d. Substitutions: Permitted with the Engineer's approval.
2. Polyethylene Pipe: Pipe shall be provided in diameters, pressure classes, and dimension ratios (DR) as shown on the plans and in accordance with ASTM D3035.

a. HDPE pipe shall be manufactured from extra high molecular weight polyethylene pipe materials meeting the requirements of cell classification PE345464C Standard PE Code Designation PE3408 as defined by ASTM D3350.
b. Fittings: AWWA C901, C906, molded.
c. Joints: Butt fusion by a qualified technician, trained by an approved manufacturer's representative, and in accordance with the manufacturer's recommended procedures.

3. Typical Material Physical Properties: All PE pipe and fitting materials shall meet these typical physical properties:
4. HDPE Fittings:
   a. The fittings shall be manufactured from the same cell class resin and fully pressure rated to the same pressure rating as the designed piping system.
   b. Shall have a controlled outside diameter and produced to the SDR/DR rating for the pressure specified by the Engineer.
   c. Shall be specifically manufactured to the standardized dimensions noted on the Drawings.
   d. Where applicable, fittings shall meet the requirement of AWWA C906.
   e. Butt fusion fittings shall be manufactured from the same material as the extruded pipe, shall be rated for the pressure service at least equal to that of the system pipe, and shall have outlets manufactured to the same DR as that of system pipe.
   f. Molded fittings shall be manufactured in accordance with ASTM D3261.
   g. Socket fittings shall be manufactured in accordance with ASTM D2683.

B. Ductile Iron Pipe for Water Service:
1. Pipe:
   a. Ductile iron pipe shall meet ANSI/AWWA A21.51/C151 specifications:
      1) ANSI A21.51 (AWWA C151).
      2) ASTM A536, Grade 60-42-10.
2. Fittings:
   a. Ductile iron, ANSI A2l.10 (AWWA C111).
   b. ASTM A536, Grade 80-60-03 or 70-50-05.
   c. Hydrostatic test: three times rated working pressure.
3. Threaded connections: ANSI B2.1 NPT.
4. Joints:
   a. Mechanical: 350 psi working pressure.
   b. Flange: DI; ANSI A21.14 or Bl6.1, 125 lb.
   c. Gaskets: ASTM DI330, Grade I.
   d. Push-on gaskets: neoprene or other synthetic rubber, D412 and D395. Natural rubber not acceptable.
   e. Lubricant: Heavy vegetable soap solution suitable for potable water use.
5. Flanged adapters:
   a. Body: ASTM Class 30 cast iron.
   b. Flanges: DI ANSI A21.15.
   c. Bolts: Steel with heavy hex nuts, ASTM A576.
   d. Gaskets: Fastite neoprene.

6. Expansion Joints:
   a. For flanged and slip-on ductile iron pipe: ASTM A36.
   b. Gaskets: Fastite neoprene with lubricating rings.
   c. Expansion joints shall be Redflex type J-1 as manufactured by the Red Valve Company, Inc. or approved equal.
      1) The expansion joints shall have a rubber inner tube, a body constructed of multiple plies of fabric impregnated with synthetic rubber, and a protective outer cover of synthetic rubber to provide resistance to deterioration from weather and ozone. Special covers shall be applied to resist weather, and ozone. Steel wire shall be imbedded in the body for additional strength. The elastomer and fabric material shall be determined by the temperature and chemical compatibility requirements.
      2) Flanges shall be constructed integrally with the body to resist stresses. Flanges shall be full-pattern so that gaskets are not necessary. Flanges shall be drilled to ANSI B16.5, Class 150#, or as specified. Retaining rings shall be Stainless Steel.
      3) The expansion joint shall be triple arch. Joint dimensions, movement, and spring rates for all variations shall follow Fluid Sealing Association guidelines. Joints shall be manufactured in the U.S.A.
      4) Number of Control Rods to be used shall follow manufacturers recommendations for required testing pressures. Required testing pressure covered in Section 3.2.B. of this specification.
7. Tapping Saddles:
   a. Ductile iron with galvanized steel straps and rubber sealing gasket.
   b. Pressure rating: 250 psi.

C. Polyvinyl Chloride for Water Service
1. Materials shall be inspected to verify that they meet these specifications and match the approved submittals. Materials not meeting these requirements shall not be permitted to be installed. Install all materials and equipment in strict accordance with the manufacturer's recommendations, applicable codes and regulations, and these specifications.
2. The unloading, handling, and storage of the pipe and materials shall be conducted in a safe manner. Handle pipe with padding between metal machinery and pipe. Keep dirt and foreign material away from pipe interiors and sealing surfaces. Lower pipe carefully into the trench without dropping, rolling or dumping the pipe.
3. General: Inspect all materials prior to installation to ensure that they are in new condition. Ensure that pipe, fittings and materials are free from defects and damage at the time of delivery and prior to installation in the trench. Plastic pipe with scratches, gouges, or grooves deeper than 10% of the wall thickness or ultraviolet discoloration shall be rejected. Remove all materials from site that are defective, damaged, used, unsound, or that otherwise do not meet the specifications within 24-hours of discovery.
4. Pipe: All pipe shall be listed under the National Sanitation Foundation (NSF) Part 61. The standard pipe length shall be 20 feet. Each length of pipe shall be

clearly marked with the following: Manufacturer, Nominal Pipe Size, PVC Cell Classification, Type PSM PVC Sewer Pipe, ASTM Designation and Pipe Class.

5. Polyvinyl Chloride Pipe (PVC): PVC pipe shall meet the requirements of NSF 14.
6. PVC Pipe and Fittings (2-inch): PVC pipe shall be SDR 21 (200 psi). Each joint of pipe shall carry the NSF seal of approval for pipes for potable water. Pipe shall conform to ASTM D2241 and ASTM D1784. Fittings shall be 2-inch SDR-21 gasketed fittings with the PVC material conforming to ASTM D1784, NSF 14, joints conforming to ASTM D3139, and gaskets (elastomeric seals) conforming to ASTM F477.
7. PVC Pipe and Fittings (4-inch to12-inch): PVC pipe and joints shall conform to the requirements of ANSI/AWWA C900 DR 18 or C909 DR18 pressure class 235 (minimum), Standard for Polyvinyl Chloride (PVC) Pressure Pipe, with gaskets meeting ASTM F477 joints conforming to ASTM D3139, and gaskets (elastomeric seals) conforming to ASTM F477 or as otherwise defined on the Bid Schedule.

2.2 Appurtenances

A. Compression Joints:
   1. For connections between flanged ductile iron pipe.
   2. Gaskets: Fastite neoprene with lubricating rings.
   3. Compression joints shall be style SB1-SGL braid as manufactured by Flexicraft, or approved equal.
      a. The compression joints shall be capable of 1-inch of compression due to building settlement.
      b. 8-inch braided metal compression joints shall be a minimum of 24 inches in length.
      c. 4-inch braided metal compression joints shall be a minimum of 20 inches in length.
      d. The core hose and end materials shall be stainless steel.

B. Resilient Wedge Gate Valves:
   1. Size as shown on Drawings.
   2. Mueller or Engineer approved equivalent.
   3. Valves shall conform to AWWA C-509 and comply with its latest revisions.
   4. The wedge shall be cast iron, fully encapsulated in molded rubber including the guides. The bronze stem nut must be rigidly enclosed in the wedge to maintain alignment.
   5. The stem shall have two O-rings above and one O-ring below the collar. Stem seats must be replaceable with the valve under pressure.
   6. The stem material shall be stainless steel (AISI420) or Engineer-approved equivalent.
   7. The waterway shall be full size to allow for tapping use; no cavities or depressions are permitted in the seat area.
   8. Valve body and bonnet shall be electrostatically applied, fusion bonded and epoxy coated, both inside and out, by the valve manufacturer. The coating shall

meet the requirements of AWWA C-550. Coating to be applied only at the valve manufacturer's facilities.

9. The bonnet bolts shall not be exposed to the environment or, alternatively, be in 316 stainless steel.
10. O-ring style seals shall be used as gaskets on the bonnet and on the stuffing box.
11. All valves must be tested by hydrostatic pressure equal to the requirements in the AWWA C-509 specifications prior to shipment from the manufacturer.
12. 2-inch AWWA operating nut for valves in below-ground service; handwheel for aboveground service.
13. Mechanical joint ends for pipe or as shown on drawings.

C. Check Valves:
1. Manufacturer: Valmatic or Engineer-approved equal.
   a. 4-inch and larger: ductile iron body, Buna-N with alloy steel and nylon reinforcement disc, ASTM A666 T302 disc accelerator, mechanical indicator, ANSI class 125 flanged ends.
   b. 250 psi working pressure.
   c. 4-inch model 7204.
   d. 8-inch model 7208.

D. Air Pressure and Vacuum Relief Valves:
1. Cast iron body, cover and baffle; stainless steel trim and float.
2. Sized for up to 250 gpm; 0 - 250 psi.
3. Seat: Buna-N.
4. 3-inch and smaller: NPT threaded outlet.
5. 4-inch and larger: Plain outlet with steel protector hood.
6. Val-Matic, Crispin or Engineer-approved equivalent.

E. Valve Boxes:
1. Cast iron, adjustable extension, traffic type.
2. Minimum thickness of metal at any point: 3/16 inch.
3. Removable cast iron cover.
4. All valve boxes for plug valves shall be designed for integral installation of the required valve position indicator.
5. Cast iron boxes: Factory painted inside and out with manufacturer's recommended asphalt paint.
6. Cover marked “Water.”

F. Gauges:
1. All gauges shall be 3 inches in diameter.
2. Each gauge shall be installed with block and bleed valves, and with a snubber and dielectric coupling.
3. Range shall be 0 to 150 psi unless otherwise noted

G. Flow Meters:
1. Magmeters shall be ABB Water Master or Engineer-approved equal.

H. Pressure Transmitter
1. Manufacturer: ABB or Engineer approved equal.

2. Model: 261GSDKB52H
3. The transmitter shall utilize a 4 – 20 mA signal for communication.

I. Locator Tape:
1. Tape shall be 6 inches wide and shall consist of one layer of metalized foil laminated between two layers of inert plastic film.
2. Laminated bonding that can be separated by hand is not acceptable.
3. Tape shall be a minimum of 5 mils thick with a minimum tensile strength of 84 lb per 3-inch width strip.
4. Tape shall be imprinted with a continuous warning message repeated a minimum of every 30 inches as follows:
   a. Blue colored tape: Caution Water line Buried Below
5. Tape shall be inductively locatable and conductively traceable using standard pipe and cable locating device for a minimum of 8 years after direct burial.
6. Test results showing a minimum of 8 years life and full compliance of these specifications and a sample of the tape may be required to be furnished to the Taos County Right-of-Way Administrator.

J. Tracer Wire
1. Manufacturer: Copperhead Industries, LLC. Or Agave Wire LTD
   a. 10 AWG copper clad steel wire or 10 AWG solid copper wire.
   b. Minimum 261-lb break load with 30 mil high molecular weight polyethylene jacket, blue color, or approved equal.
   c. Test stations shall be Snake Pit Magnetized Tracer Boxes (or engineer approved equal).
   d. Tracer box shall be rated for heavy traffic.
   e. Tracer wire shall be properly grounded at all dead ends/stubs using drive-in magnesium grounding anode rod with a minimum of 20 feet of #14 red HDPE insulated copper clad steel wire connected to anode (min 0.5 lb), specifically manufactured for this purpose.

K. Sentry Posts:
1. Metal posts.
2. Water pipeline warning sign.
3. Color: blue.

L. Hangers and Supports
1. Bolts:
   a. Carbon steel: ASTM A307
   b. Galvanized steel:
      1) Carbon steel, hot-dip galvanized, ASTM A153
      2) Zinc Plates, ASTM A164 type GS.
2. Nuts:
   a. Same material as bolts
   b. Carbon steel: ASTM 307, Grade B, heavy hexagonal.
   c. Self-locking: prevailing torque, IFI-100, Grade A.
3. Washers:
   a. Same material as bolts
   b. Flat: ANSI B27.2.

c. Locking: spring-type, ANSI B27.l.

4. Pipe rollers and supports
   a. B-Line System Inc. product as shown on plans or Engineer approved.

M. Yard Hydrants
1. Type: Freezeless yard hydrant with automatic drain-back feature
2. Inlet Connection: ¾ inch NPT or 1 inch NPT, brass
3. Outlet Connection: ¾ inch hose thread with anti-siphon vacuum breaker (where required by code), brass
4. Operation:
   a. Handle and screw
   b. Self-draining design to prevent freezing when closed
5. Rod: Galvanized steel or stainless steel
6. Pipe: Galvanized steel pipe, minimum Schedule 40
7. Valve Body: Cast iron or bronze construction with corrosion-resistant finish
8. Depth of Bury: As indicated on plans; minimum 3 feet
9. Approvals: NSF/ANSI 61 and 372 listed for potable use

N. Fire Hydrants:
1. Latest revision of AWWA C-502.
2. Mueller A423 Super Centurion 200 or Engineer-approved equivalent.
3. 1½-inch Pentagon bronze operating nut equipped with elastomer weather seal between the top casting and the operating nut.
4. Sealed oil reservoir will inmate a system of ford lubrication of the thrust collar area each time the hydrant is operated.
5. Two 2.5-inch and one 4.5-inch nozzles with National Standard fire hose threads mechanically connected into the barrel, O-ring sealed with National Standard nozzle caps.
6. Steel safety stem coupling with stainless steel fasteners and two-piece breakaway safety flange.
7. Centerline of hose nozzle will be a minimum of 18 inches above ground line.
8. 5¼-inch-diameter main valve opening.
9. Upper valve plate shall be all bronze.
10. All internal surfaces of the shoe, the lower valve plate and cap nut shall be coated with a factory-applied, two-part, thermosetting epoxy coating with a minimum thickness of 4 mil.
11. The bronze valve seat shall be threaded into a bronze drain ring or shoe bushing; the drain channel shall be all bronze.
12. The hydrant shall have two drain outlets above the lower flange of the hydrant shoe assembly.
13. 200 psi working pressure, and be certified as such by the manufacturer.
14. Lower barrel to shoe connection will have a minimum of six bolts made of stainless steel.
15. All hydrants furnished will have a standard 10-year warranty certified by the manufacturer.
16. Painted chrome yellow.
17. One Manufacturer’s hydrant wrench supplied with each hydrant installed.

2.3 Corrosion Protection

A. Ductile Iron:
1. Outside coating:
a. Bituminous, ANSI/AWWA C110, approximately 1 mil thick.
b. Strongly adherent to complete exterior of pipe.
c. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun.
2. Inside coating: Cement lined, in accordance with AWWA C-104.
3. Polyethylene encasement:
a. ANSI A21.5 Seamless tube black, ASTM Dl248.
b. Type I, Class C, Grade G-1.
c. Thickness: Min. 8 mil.
d. Joint tape: Self-sticking PVC, 10 mil thick.
e. Strapping: Non-metallic, water resistance FS PPP-S-760.
f. Buried ductile iron pipe where scheduled.
4. Hangers and Supports
a. Per drawings and details.

PART 3 EXECUTION

3.1 Installation

A. General:
1. Install as indicated on Drawings and AWWA C600: Installation of Ductile-Iron Water Mains and Their Appurtenances and AWWA C605: Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
2. Excavation and Backfilling: Section 31 23 16.
3. Pipe Cutting:
a. Pipe cutting measurement taken at site.
b. Cutting of pipe or inserting valves, fittings, or closure pieces shall be done in a neat and workman like manner without damage to the pipe.
4. Direction of Bells:
a. Unless otherwise directed, pipe shall be laid with bell ends facing the direction in which work is progressing.
b. Pipe laid on an appreciable slope shall be laid with bell ends facing uphill.
5. Pipe Plugs: At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer.
6. Pipe Cleanliness:
a. Clean all pipe, fittings, and appurtenances before use.
b. Foreign materials or objects shall be prevented from entering the pipe while it is placed in the trench.
7. Temporarily support, adequately protect and maintain all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of work.

B. Pipe Alignment and Grade
   1. All pipe shall be laid and maintained to the required lines and grades; with fittings and valves at the required locations, with joints centered and spigots home; and with all valve stems plumb.
   2. Deviations:
      a. Wherever existing utility structures or branch connections leading to main sewers or to main drains, or other conduits, ducts, pipes or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated, or reconstructed by the Contractor through cooperation with the owner of the utility, structure, or obstruction involved.
      b. No deviation shall be made from the required line or grade except with the written consent of the Engineer.
      c. The Contractor shall make all necessary explorations to determine the location of existing pipes, valves, or other underground structures. The Owner and Engineer shall furnish all available information; however, such information cannot be guaranteed as accurate.
   3. Depth of Bury:
      a. Depth of bury shall be as shown in the Plans.
      b. Minimum depth of bury is measured from the established road grade or the surface of the permanent improvement to the top of the barrels of the pipe.

C. Pipe Laying:
   1. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work.
   2. All pipe fittings, valves and hydrants shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and protective coatings and linings.
   3. Under no circumstances shall water main materials be dropped into trench.
   4. Trench shall be dewatered prior to installation of pipe.

D. Tracer Wire:
   1. Test stations shall have a minimum spacing of 500 feet.
   2. All tracer wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the tracer wire connection and the terminal for the grounding anode wire connection. Trace wire access boxes shall be provided with an adequate number of terminals for each location.
   3. Tracer wire shall be securely attached to top center of PVC piping at 6-foot intervals using tape or zip ties.
   4. Tracing wire shall be installed in the same trench as pipe during installation. The wire shall be securely bonded at all wire joints with an approved watertight connector to provide electrical continuity, and it shall be accessible at all trace wire access points.
   5. Tracer wire shall be laid flat and securely affixed to the pipe at all joints and the middle of the pipe. The wire shall be protected from damage during construction, and no breaks or cuts in the tracer wire or the tracer wire insulation shall be permitted.

6. Test stations shall be installed on the north or east side of valves.
7. Test stations shall not be recessed into cast-in-place concrete and should have positive drainage from lids.
8. The grounding anode at dead ends /stubs shall be installed in a direction 180 degrees opposite the tracer wire, at the maximum possible distance.
9. Do not coil excess wire from grounding anode. Trim the wire prior to connecting to tracer wire with a mainline to lateral lug connector.
10. Where the anode wire will be connected to a trace wire access box, a minimum of 18-inches of excess/slack wire is required after meeting the final elevation.

E. Jointing and Assembling:
1. Joints shall be installed in accordance with the manufacturer's written Installation and Operation Manual and approved submittals.
2. Lubricants: Plant based soap solution suitable for use in potable water systems.
3. Take care to prevent entrance of soil and other contaminants.
4. All lumps, blisters, burrs or excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped leaned and dry and be free from dirt, sand, grit, or any other foreign materials.

F. Clean all lines by repeated flushing after installation.

G. Disinfection: Per AWWA C651-14.

H. Pipe Sleeves:
1. For all pipes passing through concrete or masonry.
2. Install where practical before concrete is placed.
3. Sleeve seal: watertight, modular sealing element when sleeve is placed in slabs with one side against soil.

I. Joint restraint:
1. Joints shall be restrained at all tees and fittings, per the drawings.
2. Concrete thrust blocks are acceptable where mechanical restraints are not practical.
3. All aboveground piping and appurtenances shall be restrained or connected by flanges.
4. Install blocking so joints are accessible for repair.

J. Valves: Installed as shown on Drawings with valve boxes and blocking as necessary.

K. Hangers and Supports
1. Workmanship and materials shall conform to the New Mexico State Highway and Transportation Department's Standard Specifications for Highway and Bridge Construction, 2000 Edition or Latest Edition, and Special Provisions.
2. All associated hardware shall be hot dipped galvanized fabrication in accordance with ASTM A123.
3. All associated hardware shall be B-Line products or Engineer approved equal.
4. Install rods from top of deck. Prior to placing rod, the holes shall be thoroughly cleaned of dust, drilling debris and other deleterious materials. Holes shall be

saturated with water, and shall have all free water removed and dried to a saturated surface dry condition. (NMSHTD section 523.33)

5. Grout rods in cored holes with neat cement grout (NMSHTD section 523.22) or mortar (NMSHTD section 523.21)
6. After curing, give washer plates, tops of rods, washers and double nuts one coat of zinc primer. Then run a bead of silicon sealer around the perimeters of the steel washers plates. The deck surface and the surface of the plates shall be clean before applying the silicon sealer

3.2 Field Quality Control

A. All pipes and fittings tested in the presence of and to the satisfaction of the Engineer. AWWA C600 and C605 should be followed for proper pipe installation procedures and hydrostatic testing methods.

B. Test Conditions (PVC):
1. Medium: Water.
2. Perform test at 150 psi for one hour per 1,000 linear foot of pipe or 2 hours minimum.

C. Testing Equipment:
1. Pressure gauge used to perform pressure test shall be a digital type gauge with the ability to display testing pressure to one hundredth (0.01) of a psi. The pressure gauge shall be rated for at least the required testing pressure.
2. All equipment for use in supplying water for the testing procedure shall be for potable water use only. A suitable amount of chlorine should be added to the storage device in order to disinfect such device. Prior notice will be given to engineer of method used for supplying water for testing.
3. When existing water mains are used to supply test water, they should be protected from backflow contamination by temporarily installing a double check-valve assembly between the test and supply main, or by other means approved by the Engineer.
4. All testing equipment is subject to and shall be disinfected per AWWA 651prior to any test. All equipment must pass a bacteriological test prior to being placed in service.

D. Procedure (HDPE):
1. Disconnect fixtures, equipment and accessories that may be damaged by test pressure.
2. Plug ends as required.
3. Water shall be applied by means of a pump connected to the pipe in a satisfactory manner.
4. All air shall be expelled from the pipe prior to pressure testing.
5. No installation will be accepted unless the leakage is less than the number of gallons per hour as determined by the following formula:

$$L = (N\ D\ Py,)/7,400$$

where: L = allowable leakage in gallons per hour.

N = number of joints in pipeline tested.
D = nominal diameter of pipe in inches.
P = test pressure, psi.

6. Leakage shall be defined as the quantity of water that must be supplied into the pipe section being tested to maintain a pressure within 5 psi of the specified leakage-test pressure after the pipe has been filled with water and the air in the pipeline has been expelled.
7. All joints showing visible leaks shall be properly repaired. Any cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material, and the test repeated.
8. Retest repaired joints, pipes, and fittings until system is tight and test results are satisfactory to the Engineer.
9. Pipe testing and preparation for use should strictly follow AWWA C605 Section 7: Preparation for use.
10. Ductile Iron pipe hydrostatic pipe testing shall be done in accordance with section C600: Installation of Ductile-Iron Water Mains and Their Appurtenances. Previously described procedures for hydrostatic testing is for Polyvinyl Chloride (PVC) pipe only.

3.3 Pipe Schedule

A. Ductile Iron Pipe:
   1. Pipe sizes 3-inch through 12-inch, pressure class 350 psi.
   2. Flanged connections

B. Repair and/or replacement of existing water lines damaged during construction: Material generally to match existing or at least quality required by this section.

C. Provide sizes as shown on the Drawings and as provided for in the Bid Schedule.

3.4 Valve Schedule

Valve ID	Valve Type	Material	Size, inches	Number of Valves
BV-101	Ball Valve	PVC	1	20
BV-201	Ball Valve	PVC	2	9
GV-301	Gate Valve	DI	3	4
GV-401	Gate Valve	DI	4	3
CV-401	Check Valve	DI	4	1
GV-601	Gate Valve	DI	6	2
CV-601	Check Valve	DI	6	1
GV-801	Gate Valve (in building)	DI	8	1
GV-802	Gate Valve (buried)	DI	8	45
CAV-801	Combination Air/Vacuum Relief	DI	8	12
ACV-801	Altitude Control Valve	DI	8	1
GV-1001	Gate Valve	DI	10	2

3.5 Demonstration

A. Contractor shall perform a continuity test on all trace wire in the presence of the Engineer or the Engineer's representative. If the trace wire is found to be not continuous after testing, the Contractor shall repair or replace the failed segment of the wire. Passing test results shall be provided for all pipe segments within the Engineer of Record's as-built data and plan set.

END OF SECTION

SECTION 33 30 00

WASTEWATER UTILITIES

PART 1 GENERAL

1.1 Section Includes

A. Septic tank, grinder pumps, wastewater piping, fittings, and appurtenances.

1.2 Related Work

A. Section 31 23 16 Excavation and Backfill

B. Section 33 30 00 Wastewater Utilities

C. Section 33 32 13 Packaged Wastewater Pumping Stations

1.3 Submittals

A. The following shall be submitted in conformance with Section 01 33 00.
   1. Product Data (septic tank, pipe sizes, pumps, assemblies, materials and fittings)
   2. Manufacturer's installation instructions.
   3. Manufacturer's catalog information.

1.4 General Requirements

A. Pipes, pumps, fittings, and materials to be new, of highest quality and shall be in excellent condition when installed.

B. Pipe, pumps, fittings, and appurtenances of the same type and made by the same manufacturer.

C. Provide labor, equipment and materials for pipe field testing.

D. Contact and coordination with utility's owner is the full responsibility of the Contractor.

E. All products and work will meet the requirements of New Mexico Administrative Code (NMAC) 20.7.3 – Liquid Waste Disposal and Treatment.

1.5 Handling and Storage of Pipe and Appurtenances

A. Pipe, valves, and other appurtenances shall, unless otherwise directed, be unloaded, hauled and laid as follows:
   1. Pipe and appurtenances shall be lifted by hoists with broad well-padded contact surfaces, or rolled on skidways in such a manner to avoid shock.
   2. Under no circumstances shall pipe or appurtenances be dropped.
   3. Pipe must not be rolled or skidded against pipe already on the ground.

B. The Contractor shall be responsible for the safe storage of material furnished by or to them and accepted by them, and intended for the work, until it has been installed in the completed project.

C. Installation:
1. In distributing material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
2. Pipe shall be handled in a manner that only a minimum amount of damage to the pipe exterior will result. Damaged piping shall be repaired in a manner satisfactory to the Engineer or replaced.
3. The interior of all pipe, fittings, and other appurtenances shall be kept free from dirt and foreign matter at all times.

PART 2 PRODUCTS

2.1 Septic Tanks

A. Septic tanks shall be manufactured by a manufacturer approved by the New Mexico Environment Department Liquid Waste Bureau, and tanks shall meet all the requirements listed in NMAC 20.7.3.502.

B. Septic tanks shall be rated for at least incidental traffic loading, H10.

C. Septic tank shall have a 2,500-gallon capacity and installed as shown on the Drawings.

D. Manufacturer shall be Albuquerque Vault Company or Engineer approved equivalent.

2.2 Sanitary Sewer Piping

A. PVC Pipe
1. ASTM D1785, PVC 1120, Type I, Gr. 1, Cell Classification 12454, Schedule 40 or ASTM D2241 PVC (SDR Series) Cell Classification 12454 per drawings
2. Fittings: ASTM D2467 PVC plastic pipe fittings Schedule 40
3. Fittings: ASTM D2672 Joints for IPS PVC Pipe Using Solvent Cement
4. Solvent ASTM D2564
5. Location: below grade
6. Size: as shown on Drawings

B. PVC Fittings
1. Push on or threaded
2. Match pipe material

C. HDPE Piping
1. Manufacturers:
   a. ISCO Industries.
   b. Polypipe, Inc.
   c. Performance Pipe, Inc.
   d. Substitutions: Permitted with the Engineer's approval.
2. Polyethylene Pipe: Pipe shall be provided in diameters, pressure classes, and dimension ratios (DR) as shown on the plans and in accordance with ASTM D3035. Also:
   a. HDPE pipe shall be manufactured from extra high molecular weight polyethylene pipe materials meeting the requirements of cell

classification PE345464C Standard PE Code Designation PE3408 as defined by ASTM D3350.

b. Fittings: Molded.

c. Joints: Butt fusion by a qualified technician, trained by an approved manufacturer's representative, and in accordance with the manufacturer's recommended procedures.

3. Typical Material Physical Properties: All PE pipe and fitting materials shall meet these typical physical properties:

4. HDPE Fittings:

a. The fittings shall be manufactured from the same cell class resin and fully pressure rated to the same pressure rating as the designed piping system.

b. Shall have a controlled outside diameter and produced to the SDR/DR rating for the pressure specified by the Engineer.

c. Shall be specifically manufactured to the standardized dimensions noted on the Drawings.

d. Where applicable, fittings shall meet the requirement of AWWA C906.

e. Butt fusion fittings shall be manufactured from the same material as the extruded pipe, shall be rated for the pressure service at least equal to that of the system pipe, and shall have outlets manufactured to the same DR as that of system pipe.

f. Molded fittings shall be manufactured in accordance with ASTM D3261.

g. Socket fittings shall be manufactured in accordance with ASTM D2683.

2.3 Ball Valves (Plastic)

A. Manufacturer: Spears True Union 2000

1. Example Part Number: 1829-005 (½-inch Socket/ASME B1.20.1 threads; EPDM)

B. Description: Thermoplastic ball valves: True Union 2000 Industrial type manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. O-rings: EPDM or Viton®. Safe-T-Shear® stem with double O-ring stem seals. Polypropylene valve handles with built-in lockout mechanism. Valve union nuts with Buttress threads. Safe-T-Blocked® seal carriers. All valve components shall be replaceable.

C. Rating: All ½-inch through 2-inch valves shall be pressure rated to 235 psi, all 2½-inch through 8-inch venturied, and all flanged valves shall be pressure rated to 150 psi for water at 73°F.

D. Assembly Methods: welded or ASME B1.20.1 threads

2.4 Gate Valves

A. AWWA C509 resilient wedge gate valve.

B. Valves shall conform to the latest version of AWWA Standard C-509 covering Resilient Seated gate Valves for Water Supply Service.

C. The valves shall have a cast iron body, bonnet and wedge. The wedge shall be totally encapsulated with rubber.

D. The sealing rubber shall be permanently bonded to the wedge to meet ASTM tests for rubber metal bond ATSM D249.

E. Valves shall be supplied with O-Ring seals at all joints (no gaskets are used in the valve design).

F. The valves shall be rising stem, opening by turning left, and provided with 2-inch square operating nut.

G. Waterway shall be smooth, unobstructed and free of all pockets, cavities, and depressions in the seat area. Valves shall accept a full-size tapping cutter.

H. The body, bonnet and stuffing plate shall be coated with fusion bonded epoxy, both interior and exterior on body and bonnet. Epoxy shall be applied in accordance with AWWA C550 and be NSF 61 NSF372 certified. PIV plates shall be painted black.

I. Each valve shall have a maker's name, pressure rating, and year in which it was manufactured cast in the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to requirements of both AWWA and UL/FM.

J. All internal parts shall be accessible without removing the body from the line.

K. Valves shall be assembled in the USA and shall be manufactured by Mueller Company or equal.

2.5 Air Release Valve

A. Manufacturer:
   1. Val-Matic or
   2. Engineer-approved equal

B. Pressure rating up to 150 psi

C. NPT inlets/outlets

D. Body:
   1. 2-inch NTP cleanout
   2. 1-inch NPT drain connections
   3. ASTM A126 Class B cast iron

E. Vault:
   1. Pre-fabricated fiberglass vault, anti-float
   2. 4-foot diameter round basin, 4 feet deep
   3. 2-inch drain in the bottom center
   4. 48-inch fiberglass cover with 2-inch mushroom vent

2.6 Valve Boxes:

A. Cast iron, adjustable extension, traffic type.

B. Minimum thickness of metal at any point: 3/16 inch.

C. Removable cast iron cover.

D. For valves on wash water and irrigation system only: Class 200 PVC pipe.

E. All valve boxes for plug valves shall be designed for integral installation of the required valve position indicator.

F. Cast iron boxes: Factory painted inside and out with manufacturer's recommended asphalt paint.

2.7 Wastewater Treatment Effluent Flow Meter

A. Toshiba 2” Electromagnetic Flowmeter (Model #2”-GF632) or Engineer-approved equal.

PART 3 EXECUTION

3.1 Examination

A. Verify excavations are to required grade. Do not overexcavate.

3.2 Installation

A. General:
1. Excavation and Backfilling: Section 31 23 16.
2. Pipe Cutting:
a. Pipe cutting measurements taken at site.
b. Cutting of pipe or inserting valves, fittings, or closure pieces shall be done in a neat and workman like manner without damage to the pipe.
3. Pipe Plugs: At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer.
4. Pipe Cleanliness:
a. Clean all pipe, fittings, and appurtenances before use.
b. Foreign materials or objects shall be prevented from entering the pipe while it is placed in the trench.
5. Temporarily support, adequately protect and maintain all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of work.

B. Pipe Alignment and Grade
1. All pipe shall be laid and maintained to the required lines and grades; with fittings and valves at the required locations, with joints centered and with all valve stems plumb.
2. Deviations:
a. Wherever existing utility structures or branch connections leading to main sewers or to main drains, or other conduits, ducts, pipes or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated, or reconstructed by the Contractor through cooperation with the owner of the utility, structure, or obstruction involved.

b. No deviation shall be made from the required line or grade except with the written consent of the Engineer.
c. The Contractor shall make all necessary explorations to determine the location of existing pipes, valves, or other underground structures. The Owner and Engineer shall furnish all available information; however, such information cannot be guaranteed as accurate.

3. Depth of Bury:
   a. Depth of bury shall be as shown in the Plans.
   b. Minimum depth of bury is measured from the established road grade or the surface of the permanent improvement to the top of the barrels of the pipe.

C. Pipe Laying:
1. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work.
2. All pipe fittings and valves shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and protective coatings and linings.
3. Under no circumstances shall water main materials be dropped into trench.
4. Trench shall be dewatered prior to installation of pipe.

D. Tracer Wire:
1. Test stations shall have a minimum spacing of 500 feet.
2. All tracer wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the tracer wire connection and the terminal for the grounding anode wire connection. Trace wire access boxes shall be provided with an adequate number of terminals for each location.
3. Tracer wire shall be securely attached to top center of piping at 6-foot intervals using tape or zip ties.
4. Tracing wire shall be installed in the same trench as pipe during installation. The wire shall be securely bonded at all wire joints with an approved watertight connector to provide electrical continuity, and it shall be accessible at all trace wire access points.
5. Tracer wire shall be laid flat and securely affixed to the pipe at all joints and the middle of the pipe. The wire shall be protected from damage during construction, and no breaks or cuts in the tracer wire or the tracer wire insulation shall be permitted.
6. Test stations shall be installed on the north or east side of valves.
7. Test stations shall not be recessed into cast-in-place concrete and should have positive drainage from lids.
8. The grounding anode at dead ends /stubs shall be installed in a direction 180 degrees opposite the tracer wire, at the maximum possible distance.
9. Do not coil excess wire from grounding anode. Trim the wire prior to connecting to tracer wire with a mainline to lateral lug connector.
10. Where the anode wire will be connected to a trace wire access box, a minimum of 18 inches of excess/slack wire is required after meeting the final elevation.

E. Jointing and Assembling:
1. Joints shall be installed in accordance with the manufacturer’s written Installation and Operation Manual and approved submittals.

2. Take care to prevent entrance of soil and other contaminants.
3. All lumps, blisters, burrs or excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped leaned and dry and be free from dirt, sand, grit, or any other foreign materials.

3.3 Field Quality Control

A. Test Conditions (PVC):
1. Medium: Water.
2. Perform test at 150 psi for one hour per 1,000 linear foot of pipe or 2 hours minimum.

B. Testing Equipment:
1. Pressure gauge used to perform pressure test shall be a digital type gauge with the ability to display testing pressure to one hundredth (0.01) of a psi. The pressure gauge shall be rated for at least the required testing pressure.
2. All equipment for use in supplying water for the testing procedure shall be for potable water use only. A suitable amount of chlorine should be added to the storage device in order to disinfect such device. Prior notice will be given to engineer of method used for supplying water for testing.
3. When existing water mains are used to supply test water, they should be protected from backflow contamination by temporarily installing a double check-valve assembly between the test and supply main, or by other means approved by the Engineer.
4. All testing equipment is subject to and shall be disinfected per AWWA 651prior to any test. All equipment must pass a bacteriological test prior to being placed in service.

C. Procedure (HDPE):
1. Disconnect fixtures, equipment and accessories that may be damaged by test pressure.
2. Plug ends as required.
3. Water shall be applied by means of a pump connected to the pipe in a satisfactory manner.
4. All air shall be expelled from the pipe prior to pressure testing.
5. No installation will be accepted unless the leakage is less than the number of gallons per hour as determined by the following formula:

$$L = (N\ D\ Py,)/7,400$$

where: L = allowable leakage in gallons per hour.
N = number of joints in pipeline tested.
D = nominal diameter of pipe in inches.
P = test pressure, psi.

6. Leakage shall be defined as the quantity of water that must be supplied into the pipe section being tested to maintain a pressure within 5 psi of the specified leakage-test pressure after the pipe has been filled with water and the air in the pipeline has been expelled.
7. All joints showing visible leaks shall be properly repaired. Any cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this

pressure test shall be removed and replaced by the Contractor with sound material, and the test repeated.

8. Retest repaired joints, pipes, and fittings until system is tight and test results are satisfactory to the Engineer.

3.4 Demonstration

A. Contractor shall perform a continuity test on all trace wire in the presence of the Engineer or the Engineer's representative. If the trace wire is found to be not continuous after testing, the Contractor shall repair or replace the failed segment of the wire. Passing test results shall be provided for all pipe segments within the Engineer of Record's as-built data and plan set.

END OF SECTION

SECTION 33 32 13

PACKAGED WASTEWATER EFFLUENT PUMPING STATIONS

PART 1 GENERAL

1.1 Summary

A. Contractor shall furnish and install a packaged wastewater pumping station including submersible pump(s), controls, fiberglass wet well, and fiberglass basin for discharge piping, valves and flow meter, as shown on the drawings. The pumping station assembly shall be prepackaged with the rail system(s), discharge piping, check and shut-off valves, discharge fitting, and electrical conduit connection. The control panel and basin inlet hub will be field installed. After the basin has been installed, the pump(s) will be lowered down the rail system with a stainless-steel lifting cable and seated onto the disconnect fitting. The field installed sewer pipe, electrical disconnect box and all other miscellaneous equipment shall be supplied by the contractor.

B. Related Sections
1. Section 01 33 00 Submittal Procedures
2. Section 01 78 23 Operation and Maintenance Data
3. Section 33 30 00 Wastewater Utilities

1.2 Submittals

A. The following shall be submitted in accordance with Section 01 33 00:
1. Product Data:
a. Manufacturer's shop drawings showing dimensions, material of construction, pump information including pump curves
b. The capacity-head curve should indicate efficiency, kW, bhp, and NPSHR.
c. Motor characteristic curves or tabulated data (test or calculated) should indicate the speed, power factor, efficiency, current, and kilowatt input, all plotted or tabulated against percent load as abscissas.
d. Wiring diagrams
e. Operating and maintenance manuals
2. Manufacturer's Installation Instructions: Submit all manufacturers' instructions for pump installation, connection, and testing.
3. Manufacturer's Certificate: Certify pumps meet or exceed specified requirements.

1.3 Quality Assurance

A. Perform Work in accordance with relevant ANSI/HI standards and per manufacturer's instructions.

B. Maintain one copy of each product document on site.

1.4 Warranty

A. Furnish one-year manufacturer's warranty for all pumps and accessories included in this specification.

PART 2 PRODUCTS

2.1 Manufacturers

A. Zoeller Engineered Products (800) 928-7867

B. Engineer-approved equal

2.2 Operating Conditions

A. Expected operating conditions for each septic system are given below:

Location	Flow (gpm)	Total Dynamic Head (feet)
Septic Tank or WWTP Effluent	17	10

B. The electrical power source will be 120/240V, 1 Phase.

C. The system shall be constructed as a duplex configuration.

D. The dimensions, pump discharge size, and piping materials for connecting piping are shown on the Drawings.

2.3 Basin Assembly

A. The basin shall be of the dimensions shown on the Drawings.

B. It shall be supplied with an anti-floatation collar and cover, constructed of 300 psf hatched aluminum.

C. The wet-well's fiberglass laminate shall be constructed to withstand or exceed two times the assumed loading on any depth of the basin's side wall.

D. The package shall be manufactured by a firm with a minimum of 5 years of experience in producing prepackaged basin assemblies for submersible pumps.

E. Assembled inside the basin will be the rail system, discharge piping, and valves for each pump. The basin sidewall will have a factory mounted discharge fitting. Each rail system shall have a guide rail assembly with stainless steel rail pipes for ease of installation and removal of pump. A disconnect fitting shall easily engage and seal the pump to the discharge piping with minimal effort. A potting kit shall be supplied and field-installed, preventing groundwater from entering the J-box through the conduit.

F. A junction box for electrical connections shall be mounted inside the basin and have a terminal connection designated for each pump and float lead. The junction box shall be protected from moisture and gases by both an O-ring cover seal and cord seals.

G. A stainless-steel conduit fitting shall be mounted on the outside of the basin wall. Float switches will be suspended from stainless-steel float brackets. Weights, located on the float cords, will be adjusted to the liquid levels desired for an optimum pump duty cycle. The inlet hub, provided loose for field installation, shall be mounted at an elevation that allows the wastewater to flow into the basin. The inlet hub shall be installed at a location that does not interfere with the operation of the float switches.

2.4 Pumps

A. The pumps shall consist of powder coated cast iron construction and have a finned oil filled motor housing with 50-foot electrical cables. The motor shall be non-overloading and not exceed the motor rating at any point on the impeller performance curve. Additional motor protection shall be provided by a 1.15 service factor. Air-filled motors will be unacceptable because they fail to meet the heat dissipation and lubricating properties of an oil-filled motor. The motor shall be protected from water wicking through the electrical cord by isolating the cord cap junction chamber from the motor housing.

B. The pump shall be constructed with of two carbon/ceramic mechanical seals mounted in tandem. A seal leak sensing probe shall be located in the seal chamber and used to alert the operator of a lower seal failure through a panel alarm feature.

C. Silicon carbide/carbon: Lower mechanical seal/upper mechanical seal

2.5 Control Panel

A. The control panel shall be housed in a NEMA 4X enclosure with lockable hasp. The panel shall have a disconnect and motor starter for each pump. Overload protection shall be provided in the panel for pumps not having an internal overload. The panel shall include a pump starting circuit for capacitor start/capacitor run motors. Pump run lights, HOA selector switches, and seal leak indication shall be provided for each pump. The panel will have an audible and visible high-water alarm with dry contact used for remote monitoring.

B. The following features shall be provided:
1. Inner door with dead front
2. Elapsed time meter for each pump
3. Lightening arrestor
4. High-water alarm flasher
5. Manual alarm reset switch
6. Intrinsically safe relays
7. Condensation heater

PART 3 EXECUTION

3.1 General

A. The basin will be installed using a sufficient amount of concrete material on the anti-floatation collar to prevent floatation from high groundwater conditions. Additionally, 12 inches of backfill material, pea-gravel or crushed stone, shall be provided to support the sides and bottom surfaces of the basin.

B. Contractor shall be responsible for installing the panel in a manner that maintains the NEMA 4X rating. All conduit, cord connections, and enclosure openings are to be properly sealed in a manner that prevents any liquid or vapors from entering the enclosure.

C. The contractor shall also furnish and install a properly sized and rated main disconnect switch, separate from the panel, located on the electrical service side of the panel and pump per NEC code.

3.2 Testing

A. All system components shall be fully tested at the factory for proper operation. Audits indicating these tests were performed shall be recorded and kept on file.

B. Once installed, the Contractor shall complete the start-up report furnished by the factory. A copy of this report shall be kept with the Owner's records and another shall be sent to the system's manufacturer.

3.3 Warranty

A. Standard warranty shall be 12 months from date of installation or 18 months from date of manufacture, whichever comes first.

END OF SECTION

SECTION 33 34 00

ON-SITE WASTEWATER DISPOSAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Installation of septic
   2. Installation of low-pressure distribution field
   3. Pressure piping, orifices, and flushing assemblies.
   4. Inspection ports and cleanouts.

1.2 REFERENCES

A. ASTM C33 – Standard Specification for Concrete Aggregates

B. ASTM D1785 – Standard Specification for PVC Plastic Pipe, Schedules 40, 80

C. ASTM D2241 – Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe

D. ASTM D2321 – Standard Practice for Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

PART 2 PRODUCTS

2.1 SEPTIC TANK

A. Polyethylene or concrete, 2-chamber, IAPMO-approved, with integral inlet and outlet filters

B. Sized as shown on the Drawings

C. Septic tanks shall be rated for traffic loading, H-20.

D. Septic tank shall be of 2,500-gallon capacity or as shown on the Drawings.

2.2 PRESSURE LATERAL PIPING

A. Pipe: PVC, Schedule 40, ASTM D1785 or SDR-21 per ASTM D2241
   1. Diameter: 1-1/4 inch or 2 inch as specified on plans.
   2. Perforated with factory or field-drilled orifices ⅛-inch diameter at 5-foot spacing.
   3. Fittings: Schedule 40 PVC or solvent-welded fittings suitable for pressure systems.
   4. Orifices:
      a. Drill clean, burr-free holes on bottom of pipe (6 o’clock).
      b. Include orifice shields or gravel covers to prevent clogging.

2.3 MANIFOLD AND BLOW-OFF PIPE

A. Supply and return manifolds: PVC Schedule 40 or SDR-21.

B. Blow-off pipe
   1. Ball valve with union.
   2. Access riser to grade with secure cap.

2.4 CLEANOUTS AND INSPECTION PORTS

A. PVC risers, 2-inch or 4-inch diameter as required.

B. Secure, removable caps at grade

PART 3 EXECUTION

3.1 TRENCH EXCAVATION

A. Excavate trenches to depths and widths indicated on plans.

B. Maintain level trench bottoms; slope manifolds as required for drainage.

C. Remove smeared or compacted soil from trench bottom.

3.2 SYSTEM INSTALLATION

A. Install pressure laterals:
   1. Ensure pipe is level.
   2. Align orifices horizontally.
   3. Secure pipe to prevent movement during burial.

B. Install flushing assemblies and connect to manifolds.

C. Backfill with native material:
   1. Do not compact over trench.

3.3 FIELD QUALITY CONTROL

A. Perform hydrostatic or pressure test.

B. Flush each lateral and confirm even distribution.

C. Verify cleanout and flushing port accessibility.

3.4 PROTECTION

A. Mark trench location and restrict traffic.

B. Protect cleanouts from damage until project completion.

END OF SECTION