



Supplemental Technical Specifications

The following revisions and/or additions to the Technical Specifications of the
Construction Standards and Specifications
of the
City of Santa Fe Public Utilities Department, Sangre De Cristo Water Division,
are hereby made a part of the Contract Documents.

<u>Spec Section</u>	<u>Title/Description</u>	
621	Mobilization / Demobilization	621-1 – 621-4
01010	Summary of Work	01010-1 – 01010-17
01300	Contractor Submittals	01300-1 – 01300-6
01600	Product Requirements	01600-1 – 01600-12
01700	Contract Closeout	01700-1 – 01700-6
03410	Structural Precast Concrete Vaults	03410-1 – 03410-10
08650	Vault Access Door	08650-1 – 08650-4
09900	Painting and Coating	09900-1 – 09900-13
09954	Polyethylene Sheet Encasement (AWWA C105)	09954-1 – 09954-2
09955	Cold Applied Wax Tape Coating	09955-1 – 09955-3
09961	Fusion Bonded Epoxy Linings and Coatings	09961-1 – 09961-5
11400	Electromagnetic Flow Meter	11400-1 – 11400-3
15050	General Piping Requirements	15050-1 – 15050-4
15122	Flexible Pipe Couplings and Expansion Joints	15122-1 – 15122-4
15125	Wall Penetrations	15125-1 – 15125-2
15140	Pipe Supports	15140-1 – 15140-3
15240	Ductile Iron Pipe	15240-1 – 15240-7
16010	General Electrical Requirements	16010-1 – 16010-7
16111	Conduit	16111-1 – 16111-7
16124	Connectors	16124-1 – 16124-6
16130	Boxes	16130-1 – 16130-4
16141	Wiring Devices	16141-1 – 16141-3
16310	Photovoltaic System Non-Grid Tied	16260-1 – 16260-5
16400	Electric Service	16400-1 – 16400-16
16450	Secondary Grounding	16450-1 – 16450-4

APWA Specifications (For Reference)

Section 801 Installation of Water Transmission, Collector, and Distribution Lines

APWA Standard Drawings

2326	Water- Valve Box
2328	Water- Ring and Cover for Valve Box
2405A	Paving- Local-Residential Street Section
2465	Paving-Citywide Pavement Cuts For All Utilities

SECTION 621
MOBILIZATION/DEMobilIZATION

PART 1 – GENERAL

1.01 DESCRIPTION

This section describes payment for the CONTRACTOR'S mobilization and demobilization on the project.

1.02 GENERAL.

It is the intent of this specification to provide for the CONTRACTOR to:

- A. Receive 100 percent of the amount bid for mobilization by the time the CONTRACTOR has performed ten percent (10%) of the total original contract amount bid less the amount bid for mobilization and demobilization.
- B. Receive 100 percent of the amount bid for demobilization by the time the CONTRACTOR has performed one-hundred percent (100%) of the total original contract amount bid less the amount bid for mobilization and demobilization.

1.03 DEFINITIONS.

The following definitions shall apply:

- A. Total original contract amount shall mean the total amount bid as compensation for the contract.
- B. Total original contract amount less mobilization and demobilization shall mean the total amount bid as compensation for the contract less the amounts bid for mobilization and demobilization.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

This work shall consist of preparatory and final work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project; and, for all other work and operations which must be performed or costs incurred prior to beginning work on the project, and subsequent to the completion of such work.

PART 4 – PAYMENT

4.01 PAYMENT PROCEDURES FOR MOBILIZATION

The following will apply in effecting mobilization payments:

- A. When the CONTRACTOR is eligible for payment of less than five percent (5%) of the total original contract amount bid less mobilization and demobilization, the CONTRACTOR will be paid twenty five percent (25%) of the amount bid for mobilization.
- B. When the CONTRACTOR is eligible for payment of from five percent (5%) to less than ten percent (10%) of the total original amount bid less mobilization and demobilization, the CONTRACTOR will be paid fifty percent (50%) of the amount bid for mobilization minus any mobilization amount already paid.
- C. When the CONTRACTOR is eligible for payment of ten percent (10%) or more of the total original contract amount less mobilization and demobilization, the CONTRACTOR will be paid 100% of the amount bid for mobilization minus any mobilization amount already paid.

4.02 PAYMENT CALCULATIONS FOR MOBILIZATION

-
- P_M** = Mobilization Payment
 - M** = Total amount bid for Mobilization
 - f_M** = Mobilization payment percentage factor
= 0.25, or 0.50, or 1.0, as applicable
 - P_M** = **M x f_M**
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EXAMPLE 1
MOBILIZATION

Total Original Contract Amount Bid	\$110,000
Amount Bid for Mobilization.....	\$ 5,000
Amount Bid for Demobilization	\$ 3,000
Total Original Contract Amount Less Mobilization and Demobilization	\$102,000

Percent of Work Completed	f_M		M		P_M
<5% of \$102,000	0.25	x	5,000	=	\$1,250
>5% to <10% of \$102,000	0.50	x	5,000	=	\$2,500*
≥10% of \$102,000	1.00	x	5,000	=	\$5,000*
*minus previously paid amounts					

4.03 PAYMENT PROCEDURES FOR DEMOBILIZATION

The following will apply in effecting demobilization payments:

- A. When the CONTRACTOR is eligible for payment of more than ninety percent (90%) of the total original contract amount bid less mobilization and demobilization, the CONTRACTOR will be paid twenty five percent (25%) of the amount bid for demobilization.
- B. When the CONTRACTOR is eligible for payment of from ninety-five percent (95%) to less than one hundred percent (100%) of the total original amount bid less mobilization and demobilization, the CONTRACTOR will be paid fifty percent (50%) of the amount bid for demobilization minus any demobilization amount already paid.
- C. When the CONTRACTOR is eligible for payment of one-hundred percent (100%) of the total original contract amount less mobilization and demobilization, the CONTRACTOR will be paid 100% of the amount bid for demobilization minus any demobilization amount already paid.

4.04 PAYMENT CALCULATIONS FOR DEMOBILIZATION

- P_{DM} = Demobilization Payment
- DM = Total amount bid for Demobilization
- f_{DM} = Demobilization payment percentage factor
= 0.25, or 0.50, or 1.0, as applicable
- $P_{DM} = DM \times f_{DM}$

EXAMPLE 2
DEMOBILIZATION

Total Original Contract Amount Bid	\$110,000
Amount Bid for Mobilization.....	\$ 5,000
Amount Bid for Demobilization	\$ 3,000
Total Original Contract Amount Less Mobilization and Demobilization	\$102,000

Percent of Work Completed	f_{DM}	DM	P_{DM}
>90% of \$102,000	0.25	x 3,000 =	\$ 750
>95% to <100% of \$102,000	0.50	x 3,000 =	\$1,500*
≥100% of \$102,000	1.00	x 3,000 =	\$3,000*
*minus previously paid amounts			

4.05 **METHOD OF MEASUREMENT.**

Mobilization and Demobilization will be measured by lump sum units.

4.06 **BASIS OF PAYMENT**

- A. Mobilization will be paid for at the contract price per Mobilization Bid Item. The amount bid for Mobilization shall not exceed 5% of the Total Base Bid.
- B. Demobilization will be paid for at the contract price per Demobilization Bid Item. The amount bid for Demobilization shall not exceed 2% of the Total Base Bid.
- C. No additional payments will be made for demobilization and remobilization due to shutdowns or suspensions of the work or for other mobilization and demobilization activities required to complete the contract satisfactorily.

END OF SECTION

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 GENERAL

The Work to be performed under this Contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation, and services, including: fuel, power, water, and essential communications, and performing all Work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. Note: By submitting a bid for this project, the CONTRACTOR hereby acknowledges and assures the OWNER that it has sufficient experience in constructing this type of work and therefore is familiar with all combinations of materials, labor, and equipment that are required for the successful completion of this project. The Work shall be complete, and all Work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete, safe and proper construction of the Work in good faith shall be provided by the CONTRACTOR at no increase in cost to the OWNER.

1.02 CONTRACTOR'S REPRESENTATIVES

- A. At the Pre-construction Conference, the CONTRACTOR shall provide the OWNER an Organizational Chart of the CONTRACTOR'S PROJECT TEAM for the project, including responsibilities of all related personnel. At a minimum, this organizational chart should include the following key personnel: Project Manager, Project Superintendent, Safety Representative, Scheduler and Owner or Partner of the CONTRACTOR under Contract. Phone numbers or instructions on how to contact key personnel must be provided. Resumes of all project related personnel should be included for review and approval by the OWNER.

- B. An Authorized Representative must be designated, with a clear definition of the scope of this individual's authority to represent or act on behalf of the CONTRACTOR. Any limitations in the authority of this designated representative must also be clearly delineated. At all times when work is underway at the jobsite, the CONTRACTOR'S Project Manager or Superintendent shall be present at the jobsite to supervise the work. The CONTRACTOR shall also supply an alternative Authorized Representative to act on his behalf in an emergency situation or if the prime Authorized Representative is unavailable for any reason. The limits and extent of this individual's authority to act on the CONTRACTOR'S behalf must also be clearly defined. All instructions, determinations, notices and other communications given to the Authorized Representative of the CONTRACTOR shall be binding upon the CONTRACTOR. An Authorized Representative must be available by cell phone and/or radio on a twenty-four (24) hours a day, seven (7) days a week basis throughout the course of the Contract. In the event that no

Authorized Representative is available in an emergency situation requiring the CONTRACTOR'S action or should the CONTRACTOR fail to respond within two (2) hours, the OWNER may take the appropriate actions to remedy the situation at the CONTRACTOR'S expense. The CONTRACTOR, by failing to respond to the call, shall waive any rights to claims caused by the OWNER'S actions.

- C. All key personnel as described in the CONTRACTOR'S organizational chart must be approved by the OWNER prior to the commencement of work on the project. Resumes of key personnel should include related experience on three previous projects of similar magnitude and complexity. In the event that a member of the project team proves to be unsatisfactory to the CONTRACTOR and ceases to be in his employ, all substitutions must be reviewed and approved by the OWNER. Key personnel shall not be replaced without prior approval by the OWNER.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this Contract comprises construction of the following –
 1. Construction of three (3) new Master Meter facilities located at 3 different sites, with all electrical and instrumentation as detailed in the project plans.
 2. Connect to existing pipelines at the proposed facility locations.
 3. Providing electrical power as available either from local utility or by a solar power generating unit. Miscellaneous construction activities such as site grading, surfacing, and erosion protection.
- B. The Work is located in the County of Santa Fe, New Mexico.

1.04 WORK BY OTHERS

The CONTRACTOR'S attention is directed to the fact that work may be conducted at or adjacent to the Site by other contractors during the performance of the Work under this Contract. The CONTRACTOR is to conduct its operations in a manner that will minimize any interference with the Work of other contractors under separate contract with the OWNER or other entities, and shall coordinate its operations and cooperate fully, with such contractors to provide continued safe access to their respective portions of the Site, as required to perform Work under their respective contracts. The CONTRACTOR shall include in the bid price all costs associated with the successful coordination of its operations with other contractors. Copies of Contract Documents pertaining to Work conducted on or adjacent to the site are available for review upon request.

1.05 COORDINATION

- A. Existing Utilities and Structures

Known utilities and structures adjacent to or expected to be encountered in the work are shown on the drawings. The locations shown are taken from existing records and pothole utility location results; however, it is expected that there may be some discrepancies and omissions in the locations and quantities of utilities and structures shown. Those shown are for the convenience of the CONTRACTOR only, and no responsibility is assumed by either the OWNER or the ENGINEER for their accuracy or completeness.

CONTRACTOR shall protect all existing utilities within the boundaries of the work. Utilities damaged, as a result of the CONTRACTOR'S operations due to his negligence or oversight shall be repaired to the satisfaction of the OWNER of said utility at CONTRACTOR'S sole expense.

At least seven (7) days prior to start of said work, CONTRACTOR shall notify all utilities that may be affected.

For location of utilities, CONTRACTOR shall call New Mexico One Call, phone number (505)260-1990 for coordinating and identifying utility locations.

Contractor shall pothole existing utilities to verify the horizontal and vertical location of utilities a minimum of fourteen (14) days ahead of the construction activities near these utilities. If discrepancies are identified, the CONTRACTOR shall notify the OWNER and ENGINEER immediately and request a resolution. The CONTRACTOR shall allow a minimum of seven (7) days for a resolution to be provided by the OWNER.

CONTRACTOR shall protect all existing structures within the boundaries of the work and adjacent to the work. CONTRACTOR shall be responsible for visiting the site and becoming familiar with all existing structures. Existing structures damaged that were not part of this contract shall be repaired to their original condition at CONTRACTOR'S sole expense.

For convenience, the CONTRACTOR may remove and replace small structures such as mailboxes, signs, gates, walls, fences and valve boxes that indirectly interfere with the facility construction. CONTRACTOR shall notify the OWNER of each structure to be removed seven (7) calendar days prior to removal and provide temporary mailboxes, signs, fences, or other miscellaneous structures until the permanent structures are replaced. If a traffic control sign is removed, CONTRACTOR shall make arrangements to erect a temporary sign acceptable to the OWNER. All small surface structures removed shall be replaced in the same location and in as good as or better than the original condition. The cost for this work shall be considered incidental to the facility construction and shall be included in the facility costs as shown in the bid proposal.

- B. Cultural and Archaeological Resources: In the event that cultural material or human remains are encountered during excavation, CONTRACTOR shall immediately stop all work in the vicinity of the discovery, notify OWNER of the

discovery and protect the area from further disturbance. No work shall proceed in the vicinity of the discovery without written approval of OWNER.

1.06 WORK SEQUENCE AND EMERGENCY SHUT-DOWN CONSTRAINTS

- A. The CONTRACTOR shall schedule and perform the Work in such a manner as to result in the least possible disruption to the public's use of roadways, driveways, and utilities. Utilities shall include but not be limited to water, sewerage, drainage structures, ditches and canals, gas, electric, cable television, and telephone. Refer to all available plan and profile sheets for approximate location of utilities. It is the CONTRACTOR'S responsibility to locate each utility and incorporate as-built locations on the reproducible record plans, in red ink, showing proper location on each sheet where these utilities are located including depths, widths, and lengths of each utility. There is no guarantee as to exact location of each utility and no additional compensation will be made for utilities that are within a reasonable proximity of the area shown on the record plans.
- B. WEST SECTOR METER SITE: Installation of the Master Meter facility at West Sector; this includes all work as shown in the plans to provide a complete and functioning facility.
1. Existing waterline shall remain in service for the duration of the construction.
 2. Work Sequence:
 - a. Meter vault, bypass waterline (including all pipe, fittings, valves, meter, and taps to water main,) shall be ready to serve as a bypass, including disinfection, bacterial testing, pressure testing, prior to commencing work to install valve on main waterline.
 - b. Work to install valve on main water line includes installation of two linestops and one butterfly valve, including all excavation and backfill, as shown in the plans and bid items.
 - c. Should an emergency occur during construction, where the 16" DI water main is required to be shut down, the following shall occur:
 - (1) OWNER must be contacted as soon as possible, and **not later than 15 minutes** after incident occurs.
 - (2) Valve shut-off plan as shown in the plans shall be implemented **immediately** after OWNER has been notified.
 - (3) Emergency Work to correct the shut-down shall be delineated by the CONTRACTOR and OWNER.

- (4) Emergency Work to correct the shut-down is required to be approved by OWNER within **one hour** of the incident.
- (5) CONTRACTOR shall perform the Emergency Work continuously, 24 hours/day, 7 days a week, until the shut-down is corrected and water transmission is restored as verified by OWNER.
- (6) All costs to implement the Emergency Work shall be the responsibility of the CONTRACTOR.

C. Campo Conejo Meter Site: Installation of the Master Meter facility at Campo Conejo; this includes all work as shown in the plans to provide a complete and functioning facility.

1. Existing waterline may be shut down for a maximum of 12 hours for the tapping of the existing water main and connection of the meter facility.
2. The CONTRACTOR shall limit the shut-down to a minimum as required to perform the water line taps on the 12" PVC water main.
3. The CONTRACTOR shall submit a plan of the shut-down 1 week prior to performing the shut-down and may not proceed with the shut-down until the plan has been approved in writing by the OWNER.
4. The Valve shut-off plan as shown in the plans shall be implemented for the duration of the shut-down.
5. If there are any deviations, regardless of cause, from the approved shut-down that cause the shut-down to last longer than the approved shut-down plan, the CONTRACTOR shall work 24 hours a day, 7 days a week, until the water line is restored to service, as verified by the owner.
6. The CONTRACTOR shall be solely responsible for all work required to restore the water line to service.
 - a. Meter vault, bypass waterline (including all pipe, fittings, valves, meter, and taps to water main,) shall be ready to serve as a bypass, including disinfection, bacterial testing, pressure testing.
 - b. Should an emergency occur during construction, where the 12" PVC water main is required to be shut down, the following shall occur:
 - (1) OWNER must be contacted as soon as possible, and **not later than 15 minutes** after incident occurs.
 - (2) Valve shut-off plan as shown in the plans shall be implemented **immediately** after OWNER has been notified.

- (3) Emergency Work to correct the shut-down shall be delineated by the CONTRACTOR and OWNER.
- (4) Emergency Work to correct the shut-down is required to be approved by OWNER within **one hour** of the incident.
- (5) CONTRACTOR shall perform the Emergency Work continuously, 24 hours/day, 7 days a week, until the shut-down is corrected and water transmission is restored as verified by OWNER.
- (6) All costs to implement the Emergency Work shall be the responsibility of the CONTRACTOR.

D. Richards Avenue East meter site. Installation of the Master Meter facility at Richards Avenue includes all work as shown in the plans to provide a complete and functioning facility.

1. Existing waterline shall remain in service for the duration of the construction.
2. Work Sequence:
 - a. Meter vault, bypass waterline (including all pipe, fittings, valves, meter, and taps to water main,) shall be ready to serve as a bypass, including disinfection, bacterial testing, pressure testing, prior to commencing work to install valve on main waterline.
 - b. Work to install valve on main water line includes installation of two linestops and one butterfly valve, including all excavation and backfill, as shown in the plans and bid items.
 - c. Should an emergency occur during construction, where the 16" CCP water main is required to be shut down, the following shall occur:
 - (1) OWNER must be contacted as soon as possible, and **not later than 15 minutes** after incident occurs.
 - (2) Valve shut-off plan as shown in the plans shall be implemented **immediately** after OWNER has been notified.
 - (3) Emergency Work to correct the shut-down shall be delineated by the CONTRACTOR and OWNER.
 - (4) Emergency Work to correct the shut-down is required to be approved by OWNER within **one hour** of the incident.

- (5) CONTRACTOR shall perform the Emergency Work continuously, 24 hours/day, 7 days a week, until the shut-down is corrected and water transmission is restored as verified by OWNER.
 - (6) All costs to implement the Emergency Work shall be the responsibility of the CONTRACTOR.
- E. Hydrostatically pressure test all piping to 150 psi. Hydrostatic testing methods shall be in accordance with APWA Specification Section 801.

1.07 CONTRACTOR ACCESS AND USE OF PROJECT SITE

- A. THE CONTRACTOR'S USE OF THE PROJECT SITE SHALL BE LIMITED TO ITS CONSTRUCTION OPERATIONS, INCLUDING ON-SITE STORAGE OF MATERIALS, ON-SITE FABRICATION FACILITIES, AND FIELD OFFICES.

1.08 TIME OF WORK AND OVERTIME NOTIFICATION

Time of Work:

Working hours shall conform to Section 7 of the contract documents and shall be performed from 7:30 am to 4:00 pm, Monday through Friday, with a ½ hour lunch period during which the CONTRACTOR'S operations may continue. The work week shall not exceed 42-1/2 hours (including lunch periods). Work shall not be conducted on Saturdays, Sundays or legal holidays, without the written permission of the OWNER. Refer to Section 7 of the Contract Documents for additional requirements associated with the working hours.

1.09 STORAGE

Storage conditions shall be in accordance with the manufacturer's requirements and shall be acceptable to OWNER for all materials and equipment not yet incorporated into the Work but included in Applications for Payment. Such storage arrangements and conditions shall be presented in writing for OWNER review and acceptance and shall afford adequate and satisfactory security and protection. Off-site storage facilities shall be accessible to OWNER. The stored materials shall be insured for full value.

The CONTRACTOR shall coordinate with the OWNER to store materials on-site during construction.

1.10 NOTICES TO OWNERS OF ADJACENT PROPERTIES AND UTILITIES

- A. CONTRACTOR shall notify owners of adjacent property and utilities in advance of when prosecution of the Work may affect them.

- B. When it is necessary to temporarily interrupt any utility service connection, CONTRACTOR shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit any resulting inconvenience.
- C. Utilities and other concerned agencies shall be contacted at least seven days prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines. The CONTRACTOR must submit to the OWNER and each affected utility a written description of the area, time, duration, and proposed method of disruption and reparation. With the exception of emergencies and/or events that may compromise the public safety, no disruption will be allowed without the CONTRACTOR having first obtained the express written approval of the OWNER.

1.11 PROJECT MEETINGS

A. Preconstruction Conference

1. Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place which shall be attended by the CONTRACTOR'S Project Manager, its Superintendent, its Safety Representative, and its subcontractors as the CONTRACTOR deems appropriate. Other attendees will be:
 - a. OWNER'S CONSTRUCTION MANAGER;
 - b. Representatives of OWNER;
 - c. Governmental representatives as appropriate;
 - d. Others as requested by CONTRACTOR, OWNER, or OWNER'S CONSTRUCTION MANAGER;
 - e. ENGINEER; and
 - f. CONTRACTOR'S personnel assigned to Scheduling. In the event CONTRACTOR elects to utilize an outside agency to perform its scheduling requirements, the responsible personnel from such Agency is required to attend.
2. Bring to the conference the submittals prepared by the CONTRACTOR prior to the conference along with a schedule of submittals for the project.
3. The purpose of the conference is to designate responsible personnel, discuss contract requirements and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters

established. The complete agenda will be furnished to the CONTRACTOR prior to the meeting date. Any additions to the agenda by CONTRACTOR must be forwarded to the OWNER at least 24 hours prior to the scheduled meeting date and time.

4. The CONTRACTOR shall be prepared to discuss all of the items listed below.
 - a. CONTRACTOR'S assignments for safety and first aid, including Designated Competent person(s) and CONTRACTOR'S Safety Representative.
 - b. CONTRACTOR'S schedules as required by Contract.
 - c. Transmittal, review, and distribution of all documents between the CONTRACTOR and the OWNER including CONTRACTOR'S submittals, RFI'S, Survey Requests, etc.
 - d. Processing applications for payment.
 - e. Maintaining record documents.
 - f. Critical work sequencing.
 - g. Field decisions and Change Orders.
 - h. Use of project site, office and storage areas, security, housekeeping, and OWNER'S needs.
 - i. Major equipment deliveries and priorities.
 - j. Permits required for construction.
 - k. Utilities required for construction.
 - l. Contract authority and channels of communication.
 - m. Coordination with others.
 - n. Conflict resolution procedures.
5. The OWNER will preside at the pre-construction conference and will arrange for keeping and distributing the minutes to all persons in attendance.

A. Progress Meetings

1. The CONTRACTOR will schedule and hold regular on-Site progress meetings at least weekly and at other times as requested by the OWNER or as required by progress of the Work. The CONTRACTOR, OWNER and all Subcontractors active on the Site must attend each meeting. CONTRACTOR

may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.

2. The OWNER will preside at the meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings will be to review the progress of the Work, discuss safety, maintain coordination of efforts, discuss commercial issues, discuss changes in scheduling, and resolve other problems which may develop. During each meeting, the CONTRACTOR is required to present any issues which may impact his Work, with a view to resolve these issues expeditiously.

B. Subcontractor Coordination Meetings

1. The CONTRACTOR is expected to conduct regularly scheduled coordination meetings with Subcontractors, Suppliers, and Manufacturers to manage and ensure the smooth progression of the work. Request representation at each meeting by all applicable parties involved in the coordination of current activities or concerned with the planning of upcoming work. During each meeting the following topics need to be addressed:
 - a. The development of a four week look-ahead schedule (to be distributed to the OWNER at the subsequent progress meeting).
 - b. Any concerns relating to the progress of the work.
 - c. Any other items as deemed necessary by any of the related parties.

C. Pre-Activity/Specialty Coordination Meetings

Pre-Activity meetings are to be held no later than twenty-four (24) hours prior to the execution of any activity requiring inspection or as deemed necessary by the OWNER. Required attendees should include at a minimum the OWNER'S CONSTRUCTION MANAGEMENT TEAM, the CONTRACTOR'S Project Manager, Superintendent and any other related personnel.

1.12 CONTRACTOR'S REQUEST FOR INFORMATION (RFI)

- A. In the event that the CONTRACTOR determines that some portion of the Contract Documents requires additional information or interpretation, the CONTRACTOR shall submit a written statement to the ENGINEER requesting clarification on the issue. Such request must be provided by the CONTRACTOR to the ENGINEER immediately upon discovery. Prior to the submittal of the RFI, the CONTRACTOR shall carefully study and review the Contract Documents to ensure that the requested information is not contained therein. Submit only one issue to be clarified per form. The CONTRACTOR must include in a properly written RFI the following information:

1. Project number and title, RFI number (sequentially numbered), date, person requesting clarification and signature.
 2. A clear and concise summary of the issue in question and why further clarification or information is required from the OWNER.
 3. The specific drawing shall be identified by drawing number and location on the drawing sheet.
 4. The specific specification section shall be identified by section number, page and paragraph.
 5. Where applicable, the CONTRACTOR shall include his own interpretation of the drawings or specifications and why he believes such an understanding is correct.
 6. In cases requesting clarification of coordination issues, the CONTRACTOR shall include a suggested solution with necessary drawings or sketches with the RFI.
- B. Only RFI'S submitted by the CONTRACTOR will be accepted. Any clarifications required by the Subcontractors, Manufacturers, or Suppliers of the CONTRACTOR must be properly routed through the CONTRACTOR to the OWNER on the appropriate form. All RFI'S must be limited to clarifications of the Contract Documents. RFI'S shall not be used for the purpose of notifying the OWNER or ENGINEER of the following:
1. To request approval of submittals.
 2. To request approval of substitutions.
 3. To request changes which entail additional cost or credit.
 4. To request methods of performing work different than those shown or specified.
- C. If the ENGINEER determines that the RFI is not in relation to clarifications relating to the Contract Documents, such RFI will be returned to the CONTRACTOR with an explanation which may include references to other sections within the Contract for the CONTRACTOR to follow.
- D. Improper or frivolous RFI'S that are not properly prepared as detailed above, or request information that is clearly shown in the Contract Documents, will be returned to the CONTRACTOR labeled as either Improper or Frivolous with the reasons for such determination. Should additional costs be incurred by OWNER as a result of reviews of RFI'S that were deemed Improper or Frivolous, OWNER will withhold from CONTRACTOR'S payment an amount based on ENGINEER'S

current fee schedule, including applicable miscellaneous expenses, so that OWNER may reimburse ENGINEER for such reviews.

- E. After receipt of the RFI, the ENGINEER will be allowed fourteen (14) calendar days to review and respond to the issue. If additional time is required by the ENGINEER, the CONTRACTOR will be notified in writing. Responses by the ENGINEER shall not be interpreted as authorization to proceed with extra work. In the event that the CONTRACTOR believes that additional cost or time is involved from the clarification provided by the ENGINEER, the CONTRACTOR shall notify the OWNER in writing that a change order is required and the reasons for his belief that this work constitutes a change in his Contractual requirements. At no point in time is the CONTRACTOR to proceed with extra work without the written consent of the OWNER.

1.13 DAILY ACTIVITIES REPORT

- A. Commencing with the date of Notice to Proceed, which shall be considered as Contract Day No. 1, the CONTRACTOR shall prepare and forward to the ENGINEER a Daily Activity Report. A Daily Activity Report shall be executed by the CONTRACTOR for each Contract day, for each shift, whether work takes place or not. Report shall be submitted to the ENGINEER either at the end of each working week or the following morning prior to the start of operations. This report shall contain not less than the following data:
 - 1. CONTRACTOR.
 - 2. Contract name and number.
 - 3. Contract day, date and shift.
 - 4. All personnel engaged in the Contract, including management, supervisory, clerical, engineering and manual.
 - 5. An exact count of personnel hours by trade, craft, duties, CONTRACTOR or Subcontractor.
 - 6. An exact account of all equipment that is on site or committed to the Contract, indicating hours worked and idle.
 - 7. All personnel hours and equipment hours shall be identified by the activity number or node displayed in the approved construction schedule.
 - 8. List all accidents.
 - 9. List all Subcontractors active on site.
 - 10. Name and Signature of CONTRACTOR'S Authorized Representative.

11. Work performed, including area (i.e. - station).
12. Conflicts encountered.

B. AS-BUILT DRAWINGS

1. The CONTRACTOR shall, during progress of the work, keep a careful record of all changes and corrections to the Contract Drawings. This record shall show the actual field locations, all project conditions, configurations, and any other changes or deviations that vary from the details provided in the original Contract drawings. The horizontal and vertical locations of any buried or concealed construction and utility features that were either not shown on the drawings or vary from the locations indicated, shall be carefully recorded. Include detailed sketches to fully illustrate the constructed work. The as-built drawings shall be available for review by the OWNER or the ENGINEER at all times during the construction period. At the end of each month, prior to each monthly progress payment, the CONTRACTOR shall provide a paper and electronic copy of the survey as-built file for review by the ENGINEER. If these drawings are not found to be complete and up-to-date, a non-compliance report will be issued and an additional ten (10) percent will be withheld from the CONTRACTOR'S progress payment in addition to the specified Liquidated Damages. If the OWNER receives a written notice of the correction of the condition that resulted in the withholding, signed by an authorized agent of the CONTRACTOR, the OWNER shall pay the amount withheld within 30 days after receiving the next progress estimate.
2. The as-built drawing format shall be red-line mark-ups on a set 24" x 36" drawing paper prints.
3. Upon completion of construction and prior to final payment, the CONTRACTOR shall submit to the OWNER two (2) copies of the red-lined mark-ups showing all changes, including the type, make, model, class, manufacturer, etc., as applicable, of all major items of material used in the project as well as the source of all said items.
4. Throughout the construction period and at all work areas, utilize the project coordinate system and bench marks to survey and record the horizontal and vertical location (using the survey control information provided in the plans) of new transmission line and appurtenances and existing utilities and improvements within the work area. Annotate the diameter, material and type of utility encountered. ~~Assign each utility type to a unique drawing layer. Submit the proposed drawing nomenclature, layer listing and workplan to the ENGINEER for review prior to start of field work.~~
5. The as-built and utilities surveying shall be performed under the direct control and personal supervision of a person who is duly registered as a professional

land surveyor and is currently authorized to practice as such in the State of New Mexico.

- a. Buried Utilities grades and alignments shall be surveyed at all changes in horizontal and vertical alignment or a minimum 20 foot interval, whichever is greater. New utilities parallel to transmission lines and existing parallel utilities uncovered by construction shall be surveyed at all changes in direction. Utility crossings shall be surveyed with a minimum of two or more points, one at each side of the excavation and at intermediate changes in horizontal and vertical grades. ASCII point files depicting this information shall include x, y, z and description fields. Electronic drawing files shall be annotated and configured with two dimensional lines with attached elevations (three dimensional lines will be rejected).
- b. In addition to the as-built drawings described in Paragraph 1.17.B, provide an electronic as-built file in AutoCAD Release 2008 following the specified requirements above. At the preconstruction conference, the ENGINEER will provide to the CONTRACTOR an electronic copy of the project digital mapping database for use.

Prior to each payment application submittal, the CONTRACTOR shall provide a paper and electronic copy of the survey as-built file for review by the ENGINEER. The electronic as-built file shall be provided via email or other acceptable format along with a hard copy signed and stamped by a New Mexico Registered Professional Surveyor.

6. Survey Services Requirements: The CONTRACTOR shall perform the survey services specified below.
 - a. Description: This work shall consist of construction staking lines, grades and layouts by the CONTRACTOR in accordance with the plans and specifications and as directed by the ENGINEER, as-built surveying of newly constructed utilities, structures and improvements, surveying of existing buried utilities encountered during construction and production and delivery of electronic survey data.
 - b. Materials: The CONTRACTOR shall furnish all stakes, templates, straightedges, surveying equipment and other devices necessary for establishing, checking, marking, and maintaining points, including P.I.'s, P.C.'s, P.T.'s, and lines, grades and layouts. As directed by the ENGINEER, points shall be referenced so that they may later be re-established.
 - c. Construction Requirements (Construction Staking by the CONTRACTOR): Construction staking by the CONTRACTOR shall include use of vertical and horizontal survey control points to establish

construction survey points and establish additional bench marks as necessary; setting grades for pipes, structures, culverts or drains, slopes, subgrade, subbase, base course, paving, and any other points or elevations deemed necessary for proper control of the work.

Field notes shall be kept in standard field notebooks and shall become the property of the OWNER upon completion of the Work. The standard field notebooks shall be made available to the ENGINEER upon request at any time during the prosecution of the work.

Any discrepancies in grade, alignment, locations, and/or dimensions detected by the CONTRACTOR shall immediately be brought to the attention of the ENGINEER.

The CONTRACTOR shall employ sufficient qualified personnel experienced in surveying and layout to complete the work accurately. The construction staking shall be performed under the direct control and personal supervision of a person who is duly registered as a professional land surveyor and is currently authorized to practice as such in the State of New Mexico. The CONTRACTOR shall present the credentials of the surveyor at the preconstruction conference for review and approval by the ENGINEER. Any errors in the construction of the project because of the construction staking detected by the ENGINEER shall be corrected by the CONTRACTOR. Any overruns resulting from the CONTRACTOR'S errors will be at the expense of the CONTRACTOR.

The ENGINEER may check the accuracy of the construction stakes, lines, grades and layouts but will assume no responsibility for the accuracy or the final result of the construction stakes, lines, grades and layouts.

7. Method of Measurement: Construction staking, as-built and utilities surveying by the CONTRACTOR as specified herein shall each be measured as a lump sum unit.
8. Basis of Payment: Construction staking, as-built and utilities surveying by the CONTRACTOR will be paid for as a percentage of the total contract completion times the contract lump sum bid price and all necessary personnel, equipment and supplies to accomplish this work shall be incidental to the Contract Unit Bid Price of this item.

No adjustments in the lump sum price will be made for staking required due to normal increases in contract items.

C. PERMITS FOR WORK OUTSIDE NORMAL WORKING HOURS

1. If necessary, CONTRACTOR shall obtain all permits and/or variances required to permit work outside of normal working hours, including Extended Hours of Construction if required on this project.

D. PERMITS

The CONTRACTOR shall procure all permits and encroachments except for those already obtained by the OWNER.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS

As stated in the Santa Fe County Utilities Department Water Division Construction Standards and Specifications Supplemental Specifications, Supplemental Specifications shall take priority over the standard specifications.

PART 3 – EXECUTION

3.01 SEQUENCE OF WORK / CONSTRAINTS

The work associated with this project shall be accomplished in the sequence of work deemed necessary by the CONTRACTOR and in adherence to work constraints as specified in Section 1.06.

PART 4 – MEASUREMENT AND PAYMENT

4.01 GENERAL

Costs for the work in this Section shall not be paid for separately, but shall be considered incidental to the contract work to be accomplished, unless otherwise noted.

END OF SECTION

SECTION 01300
CONTRACTOR SUBMITTALS

PART 1 – GENERAL

1.01 GENERAL

- A. CONTRACTOR "Submittals" may be Shop Drawings, schedules, surveys, reports, samples, plans, lists, drawings, documents, findings, programs, manuals, data, or any other item or information required by the Contract Documents to be submitted or offered by the CONTRACTOR in accomplishing the Work.
- B. Wherever Submittals are required hereunder, all such documents shall be furnished to the ENGINEER.
- C. The CONTRACTOR shall be responsible for the accuracy, completeness, and coordination of all Submittals, including but not limited to, Submittals of or from an item, product, thing, service, person or firm which is specified in the Contract Documents; such specified Submittals shall not be presumed to be acceptable to the OWNER and shall be subject to the same approval process as all other Submittals. The CONTRACTOR shall not delegate this responsibility in whole or in part to any Subcontractor. Submittals may be prepared by the CONTRACTOR, Subcontractor, or Supplier, but the CONTRACTOR shall ascertain that each Submittal meets the requirements of the Contract and the Project. The CONTRACTOR shall ensure that there is no conflict with other Submittals and shall notify the OWNER'S CONSTRUCTION MANAGER in each case where its Submittal may affect the work of another Contractor or the OWNER. The CONTRACTOR shall ensure coordination of Submittals of related crafts and Subcontractors.
- D. Failure to make timely submittals in accordance with the requirements of the specifications shall constitute grounds for the OWNER to withhold payment.

1.02 PRE-CONSTRUCTION CONFERENCE SUBMITTALS

At the preconstruction conference, submit the following items for review:

- A. A preliminary schedule of Shop Drawings, Samples, and proposed Substitute ("Or-Equal") submittals.
- B. A list of all permits and licenses the CONTRACTOR shall obtain indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.
- C. A preliminary schedule of values.
- D. A graphic construction schedule prepared by the critical path method of analysis, listing all significant construction activities and items of work, in expected sequence and depicting expected duration.

- E. The names and qualifications of Key Personnel as described in Section 01010: SUMMARY OF WORK.

1.03 PROGRESS REPORTS

- A. Furnish a progress report to OWNER'S CONSTRUCTION MANAGER with each Application for Payment. If the Work falls behind schedule, submit additional progress reports at such intervals as OWNER'S CONSTRUCTION MANAGER may request.
- B. Each progress report shall include sufficient narrative to describe any current and anticipated delaying factors, effect on the construction schedule, and proposed corrective actions. Any Work reported complete, but which is not readily apparent to OWNER'S CONSTRUCTION MANAGER, must be substantiated with satisfactory evidence.
- C. Each progress report shall include a list of the activities completed with their actual start and completion dates, a list of the activities currently in progress, and the number of working days required to complete each.

1.04 SHOP DRAWINGS

- A. Wherever called for in the Contract Documents, or where required by the ENGINEER, furnish to the ENGINEER for review, six copies of each Shop Drawing Submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. Whenever the CONTRACTOR is required to submit design calculations as part of a Submittal, such calculations shall bear the signature and seal of a professional engineer registered in New Mexico unless otherwise directed.
- B. All Shop Drawing Submittals shall be accompanied by a Submittal transmittal form acceptable to the ENGINEER. Any Submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal.
- C. Organization
 - 1. A single Shop Drawing Submittal transmittal form shall be used for each technical specification section or item or class of material or equipment for which a Submittal is required. A single Submittal covering multiple sections will not be acceptable, unless the primary specification references other sections for components. Example: If a pump section references other sections for the motor, protective coating, anchor bolts, local control panel, and variable frequency drive, a single Submittal would be accepted; a single Submittal covering vertical turbine pumps and horizontal split case pumps would not be acceptable.

2. On the transmittal form, index the components of the Submittal and insert tabs in the Submittal to match the components. Relate the Submittal components to specification paragraph and subparagraph, drawing number, detail number, schedule title, or room number or building name, as applicable.
3. Unless otherwise approved by OWNER, terminology and equipment names and numbers used in Submittals shall match the Contract Documents.

D. Format

1. Minimum sheet size shall be 8.5 inches by 11 inches. Maximum sheet size shall be 24 inches by 36 inches. Every page in a Submittal shall be numbered in sequence. Each copy of a Submittal shall be collated and stapled or bound, as appropriate. The ENGINEER will not collate copies.
2. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with all pertinent data, capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports. Sufficient level of detail shall be presented for assessment of compliance with the Contract Documents.
3. Each Submittal shall be assigned a unique number. Submittals shall be numbered sequentially. The Submittal numbers shall be clearly noted on the transmittal. Original Submittals shall be assigned a numeric Submittal number. Resubmittals shall bear an alphanumeric system that consists of the number assigned to the original Submittal for that item followed by a letter of the alphabet to represent that it is a subsequent Submittal of the original. For example, if Submittal 25 requires a resubmittal, the first resubmittal will bear the designation "25-A" and the second resubmittal will bear the designation "25-B" and so on.

E. Disorganized Submittals which do not meet the requirements above will be returned without review.

F. Except as may otherwise be indicated herein, the ENGINEER will return each Submittal to the CONTRACTOR, with its comments noted thereon, within 14 calendar days following their receipt by the ENGINEER. For resubmittal of Submittals, the ENGINEER will be allowed the same review period as for the original Submittal. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable Submittal to the ENGINEER by the second submission of a Submittal item. Should the ENGINEER be required to review third and subsequent submittals, OWNER will withhold from CONTRACTOR'S next payment request an amount based on ENGINEER'S current fee schedule, including applicable miscellaneous expenses, so that OWNER may reimburse ENGINEER for such reviews.

G. If three copies of a Submittal are returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said Submittal will

not be required.

- H. If three copies of a Submittal are returned to the CONTRACTOR marked “MAKE CORRECTIONS NOTED,” formal revision and resubmission of said Submittal will not be required.
- I. If a Submittal is returned to the CONTRACTOR marked “NOTE MARKINGS-RESUBMIT,” the CONTRACTOR shall revise said Submittal and resubmit the required number of copies. Resubmittal of portions of multi-page or multi-drawing Submittals will not be allowed. For example, if a Shop Drawing Submittal that consists of ten drawings contains only one drawing that needs to be amended and resubmitted, the Submittal as a whole is deemed as “NOTE MARKINGS-RESUBMIT,” and all ten drawings of the Submittal are required to be resubmitted.
- J. If a Submittal is returned to the CONTRACTOR marked “REJECTED-RESUBMIT,” the CONTRACTOR shall revise said Submittal and resubmit the required number of copies. Resubmittal of portions of multi-page or multi-drawing Submittals will not be allowed. For example, if a Shop Drawing Submittal that consists of ten drawings contains only (one) drawing that is rejected and needs to be resubmitted, the Submittal as a whole is deemed as “REJECTED-RESUBMIT,” and all ten drawings of the Submittal are required to be resubmitted.
- K. Any changes made on a resubmittal, other than those made or requested by the ENGINEER or OWNER’S CONSTRUCTION MANAGER, shall be identified and flagged on the resubmittal.
- L. Fabrication of an item shall commence only after the ENGINEER has reviewed the pertinent Submittals and has returned copies to the CONTRACTOR marked either “NO EXCEPTIONS TAKEN” or “MAKE CORRECTIONS NOTED.” Corrections indicated on Submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the Contract requirements.
- M. All CONTRACTOR Shop Drawing Submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR prior to submission. Each Submittal shall be dated and signed with the following: “I have verified that the equipment or material in this Submittal meets all the requirements specified or shown in the Contract Documents without exception.” In the case of Shop Drawings, each sheet shall be so dated, signed, and certified. No consideration for review of any submittals will be made for any items which have not been so certified. All non-certified submittals will be returned without action taken, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.
- N. The OWNER’S CONSTRUCTION MANAGER’S and/or ENGINEER’S review of Shop Drawing Submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions and for compliance with the Contract Documents. The CONTRACTOR shall assume all responsibility and

risk for any problems due to any errors in Submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

- O. No changes in the Contract times will be considered for schedule delays resulting from non-compliant Submittals.
- P. Within 30 Days of the Notice to Proceed, the CONTRACTOR shall submit a complete list of anticipated Submittals which includes Specification and Drawing references. The list shall be updated with "early start" Submittal dates within 15 Days of Submittal of the CONTRACTOR'S construction schedule. The Submittal dates shall be updated whenever the schedule is updated. Any additional Submittals identified after the initial Submittal shall be included in the updates.
- Q. If the CONTRACTOR submits an incomplete Submittal, the Submittal may be returned without review. A complete Submittal shall contain sufficient data to demonstrate that the items contained therein comply with the Contract Documents, meet the minimum requirements for Submittals as described in the Contract Documents, and include all corrections as required from previous Submittals.

1.05 SAMPLES

- A. Whenever in the Specifications samples are required, submit not less than three samples of each item or material to the OWNER'S CONSTRUCTION MANAGER for acceptance at no additional cost to the OWNER.
- B. Samples, as required herein, shall be submitted for acceptance a minimum of 21 days prior to ordering such material for delivery to the jobsite, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the Work.
- C. All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and Manufacturer's name for identification. Upon receiving acceptance of the ENGINEER, one set of the samples will be stamped and dated and returned to the CONTRACTOR, and one set of samples will be retained, and one set of samples shall remain at the job site until completion of the Work.
- D. Unless indicated otherwise, all colors and textures of specified items presented in sample Submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in contract time or price, clearly indicate same on the transmittal page of the Submittal.

1.06 SURVEY DATA

The CONTRACTOR shall make available for examination throughout the construction period all field books, notes, and other data developed by CONTRACTOR in performing the surveys required by the Work and shall submit all such data to OWNER'S CONSTRUCTION MANAGER with documentation required for final acceptance of the Work.

1.07 UTILITY INVESTIGATION

The CONTRACTOR shall submit the findings of all utility investigations performed.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

PART 4 – PAYMENT

Costs for the work in this Section shall not be paid for separately, but shall be considered incidental to the Contract work to be accomplished.

END OF SECTION

SECTION 01600
PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the contract.

1.02 SUMMARY

A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products, and includes:

1. Substitution requests.
2. Basis-of-design specification.
3. Single source.
4. Product delivery, storage, and handling.
5. Product warranties.
6. Product options.
7. Product selection procedures.
8. Comparable products.
9. Product Substitutions.

1.03 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the items "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of the effective date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content

materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.

3. **Comparable Products:** Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product. Burden of proof of acceptability as a comparable product, or better product, is the responsibility of the CONTRACTOR, and shall be fully investigated and documented by the CONTRACTOR prior to submittal to the ENGINEER for consideration.
- B. **Substitutions:** Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by CONTRACTOR.
- C. **Basis-of-Design Product Specification:** Where a specific manufacturer's product is named whether accompanied or not by the words "basis of design," including make or model number or other designation to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers. The product named shall be used to judge the minimum standard for compliance of any product used for the application intended. Other products will not be approved for use on the project that are not at least equal to, or better than, the product named, as judged by the ENGINEER.
- D. **Manufacturer's Warranty:** Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to OWNER.
- E. **Special Warranty:** Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for OWNER.

1.04 SUBMITTALS

- A. **Substitution Requests:** Refer to "Product Substitutions" Article 2.02. With the submittal of the bidding documents, the CONTRACTOR shall submit to the ENGINEER three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number, title, and Drawing numbers and titles.
 1. **Substitution Request Form:** Use form as provided at the back of this Specification Section. Improperly or incompletely filled out form may be returned to CONTRACTOR, without action by ENGINEER, for correction.
 2. **Documentation:** Show compliance with requirements for substitutions and the following, as applicable:

- a. Statement indicating why specified material or product couldn't be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by OWNER and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of CONTRACTOR'S Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. CONTRACTOR'S certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. CONTRACTOR'S waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. By making request for substitution, when forwarded by the CONTRACTOR to the ENGINEER, the CONTRACTOR:

- a. Represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
 - b. CONTRACTOR and the manufacturer will provide the same, or better, guarantee for the substitution that they would for that specified;
 - c. Certifies that the cost data presented is complete and includes all related costs under this Contract, but excludes costs under any separate contracts and the ENGINEER'S redesign costs, and that he waives all claims for additional costs related to the substitution which subsequently becomes apparent; and;
 - d. Will coordinate the installation of the accepted substitute making such changes as may be required for the Work to be complete in all respects.
4. OWNER and ENGINEER'S Action: The OWNER and ENGINEER may reject or allow substitutions, at their sole judgment and discretion. If necessary, ENGINEER will request additional information or documentation for evaluation within 7 calendar days of receipt of a request for substitution. ENGINEER will notify the CONTRACTOR of acceptance or rejection of proposed substitution within 14 calendar days of receipt of request, or 7 calendar days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Submittal marked "Approved".
 - b. Use product specified if ENGINEER does not render a decision on use of a proposed substitution within time allocated.
5. Substitutions will not be considered if:
- a. They are indicated or implied on Shop Drawings, Product Data, or Sample submissions without the formal Substitution Request; or
 - b. For their implementation, they require a substantial revision of the Contract Documents or work of the OWNER or separate Contractors in order to accommodate their use.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01300 – Contractor Submittals.

1.05 QUALITY ASSURANCE

- A. Compatibility of Options: If CONTRACTOR is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

- B. Single Source: All materials or products related to a specified warranty shall be from the same prime product manufacturer, or approved in writing by the prime product manufacturer, and installed by the same entity; providing the OWNER with a single source system warranty.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.
 - 5. Store products to allow for inspection and measurement of quantity or counting of units.
 - 6. Store materials in a manner that will not endanger Project structure.
 - 7. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
 - 8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 9. Protect stored products from damage.
- B. Storage: Provide a secure location and enclosure, as necessary, at Project site for storage of materials and equipment by OWNER'S construction forces. Coordinate location with OWNER.

1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents, and Manufacturer's standard warranty. Manufacturer's disclaimers and limitations on product

warranties do not relieve CONTRACTOR of obligations under requirements of the Contract Documents.

- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate for properly executed.
 - 3. Refer to other Supplemental Specification Section(s) for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in COA General Conditions Section 13 "Warranty and Guarantee."

PART 2 - PRODUCTS

2.01 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. OWNER reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 3. Where products are accompanied by the term "as selected," ENGINEER will make selection.
 - 4. Where products are accompanied by the term "match sample," sample to be matched is ENGINEER'S.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 - 6. Or Equal: Where a product is specified and accompanied by the term "or equal" or "or approved equal" or "or approved," or similar language; comply with provisions in "Comparable Products" and "Substitution Requests" requirements to obtain approval for use of an unnamed product. The term "equal" shall not be construed as requiring products to be exact in every characteristic, unless the ENGINEER determines that exact matching of all

characteristics is required for the intended result. The term “equal” shall, subject to the ENGINEER’S interpretation, mean generally equivalent in essential features for quality and performance for the intended result. The ENGINEER shall be the sole judge of the essential features for quality and performance, and the intended result.

- B. Product Selection Procedures: Procedures for product selection include the following:
1. Product: Where Specification paragraphs or subparagraphs titled “product” name a single product and manufacturer, provide the product named.
 - a. Substitutions may be considered, unless otherwise indicated as “no substitute,” or similar wording.
 2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled “Manufacturer” or “Source” name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
 - a. Substitutions may be considered, unless otherwise indicated as “no substitute,” or similar wording.
 3. Products: Where Specification paragraphs or subparagraphs titled “products” introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 - a. Substitutions may be considered, unless otherwise indicated as “no substitute,” or similar wording.
 4. Manufacturers: Where Specification paragraphs or subparagraphs titled “Manufacturers” introduce a list of manufacturers’ names, provide a product by one of the manufacturers listed that complies with requirements.
 - a. Substitutions may be considered, unless otherwise indicated as “no substitute,” or similar wording.
 5. Available Products: Where Specification paragraphs or subparagraphs titled “Available Products” introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in “Comparable Products” and “Substitution Request” Articles to obtain approval for use of an unnamed product and products from the Albuquerque Bernalillo County Water Utility Authority Approved Products List.
 6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled “Available Manufacturers” introduce a list of manufacturers’ names, provide a product by one of the manufacturers listed or another manufacturer

that complies with requirements. Comply with provisions in “Comparable Products” and “Substitution Requests” Articles to obtain approval for use of an unnamed manufacturer’s product.

7. Product Options: Where Specification paragraphs titled “Product Options” indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in “Comparable Products” Article.
8. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled “Basis-of-Design Products” are included and also introduce or refer to a list of manufacturers’ names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in “Comparable Products” and “Substitution Requests” Article to obtain approval for use of a product.
 - a. Substitutions will not be considered, unless otherwise indicated
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches ENGINEER’S sample. ENGINEER’S decision will be final on whether a proposed product matches satisfactorily.
 - a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of “Product Substitutions” for selection of a matching product.
10. Visual Selection Specification: Where Specifications include the phrase “as selected from manufacturer’s colors, patterns, textures” or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase “standard range of colors, patterns, textures” or similar phrase, ENGINEER will select color, pattern, or texture from manufacturer’s product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase “full range of colors, patterns, and textures” or similar phrase, ENGINEER will select color, pattern, or texture from manufacturer’s product line that includes both standard and custom or premium items.

2.02 PRODUCT SUBSTITUTIONS

- A. Timing: Refer to “Substitution Requests.” ENGINEER will consider requests for substitution if received within 15 days after award of contract. Requests received after that time may be considered or rejected at discretion of ENGINEER. After that time, CONTRACTOR has the burden of proof that the substitution is requested due to events or specified product unavailability beyond the CONTRACTOR’S control.
- B. Conditions: ENGINEER will consider CONTRACTOR’S request for substitution when, in the ENGINEER’S judgment, the following conditions are satisfied. If the following conditions are not satisfied, ENGINEER will return requests without action, except to record noncompliance with these requirements:
1. Requested substitution offers OWNER a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities OWNER must assume. OWNER’S additional responsibilities may include compensation to ENGINEER for redesign and evaluation services, increased cost of other construction by OWNER, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated or better results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect CONTRACTOR’S Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified or better warranty.
 10. Requested substitution is due to events or specified product unavailability beyond the CONTRACTOR’S control.

2.03 COMPARABLE PRODUCTS

Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named on the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified or better warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
5. Samples, if applicable, or requested.

PART 3 – EXECUTION

3.01 CONTRACTOR SUBSTITUTION REQUEST FORM IS ATTACHED.

PART 4 – MEASUREMENT AND PAYMENT

Costs for the work in this Section shall not be paid for separately, but shall be considered incidental to the contract work to be accomplished.

END OF SECTION

CONTRACTOR SUBSTITUTION REQUEST FORM

The undersigned, as CONTRACTOR for the above project, requests that the following product be accepted for use in the Project in lieu of _____ Specified in Section _____

PRODUCT: _____

MODEL NO: _____

MANUFACTURER: _____

ADDRESS: _____

Reason for substitution request is as follows: _____

The following items are attached:

- Product description including specifications, performance and test data, and applicable reference standards.
- Samples
- Tabulated comparison with specified product.
- Documentation of reason for request.
- Cost data for comparing proposed substitution with specified product.
- Other: _____

The undersigned certifies that unless stated otherwise:

- Proposed substitution has been thoroughly investigated and function, appearance, and quality meet or exceed that of specified product.
- Same warranty will be provided for substitution as for specified product.

Use of substitution will not adversely affect:

- Dimensions shown on Drawings.
- Construction schedule and date of completion.
- Work of other trades.
- Maintenance service and replacement parts for proposed substitution will be readily available in Albuquerque area.

Any changes to Contract Sum related to use of proposed substitution are included in price listed below. CONTRACTOR waives claims for additional costs related to acceptance of substitution, which may subsequently become apparent.

Costs of modifying project design caused by use of proposed substitution, which subsequently become apparent, will be paid for by CONTRACTOR.

If substitution request is accepted:

- Contract Sum will be (decreased, increased) by \$ _____
- Contract Time will be (decreased, increased)by \$ _____ calendar days

Submitted By:

CONTRACTOR/SUPPLIER

ADDRESS: _____

TELEPHONE NUMBER: _____

NAME OF PERSON SUBMITTING REQUEST: _____

TITLE: _____ DATE: _____

SECTION 01700
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1. SECTION INCLUDES

- A. Contract Closeout Procedures and Submittals.

1.2. CLOSEOUT PROCEDURES

- A. Upon completion of the work certify 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 the Contract Documents;
 - 4. Equipment and systems have been tested as required, and are operational;
 - 5. Work is completed and ready for final inspection.
- B. Should the work be found to be incomplete or defective, the Engineer will notify the Contractor in writing, listing the incomplete or defective work.
- C. Correct the deficiencies promptly, and notify the Engineer when the work is ready for re-inspection.
- D. When the work is determined to be acceptable, the Engineer will request the Contractor to make closeout submittals.

1.3. FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances.
- C. Clean equipment and fixtures to a sanitary condition.
- D. Clean filters of operating equipment.
- E. Clean site; sweep paved areas.
- F. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4. TRAINING

- A. Prior to final inspection or acceptance, fully instruct Owner-designated personnel in the operation, adjustment and maintenance of equipment and systems.
- B. Use maintenance and operating manuals as the basis of instruction.
- C. Perform training by instructors skilled in the operation of equipment. Use equipment manufacturers' representatives to provide instruction for major equipment.

1.5. TRANSMITTAL OF SUBMITTALS

- A. Transmit submittals per Section 01300, Submittals.

1.6. CONTRACT CLOSEOUT SUBMITTAL REQUIREMENTS

- A. Prepare and submit Contract Closeout Submittals based on Section 01300, Contractor Submittals.
- B. Contract Closeout Submittals will include those approved per Section 01300, Contractor Submittals.

1.7. DEFINITION OF CONTRACT CLOSEOUT SUBMITTAL TYPES

- A. Provide the following types of Contract Closeout Submittals:
 - 1. Operations and Maintenance Manuals and Instructions/Data.
 - 2. Warranties and Software Licenses.
 - 3. Project Record Documents.
 - 4. Final Application for Payment.
 - 5. Consent of Surety.
 - 6. List of all Claims.
 - 7. Release of liens or waivers
 - 8. Certification of Labor Standards for Required Closeout Submittals.

1.8. OPERATIONS AND MAINTENANCE FACILITY MANUALS (O&M MANUALS)

- A. Provide Operations and Maintenance Instructions in 8½ x 11 inch three-side ring binder with durable covers, as manufactured by The Loose Leaf House, Vernon California, Binder Model No. 178097, or Engineer approved equal. Provide binders with clear pockets on front and binding edge for insertion of titles. Do not fill binders more than 75% full.

In addition, two CD's, each containing a pdf file of the same O&M material in the binder shall be submitted.

B. Prepare binders and CD's with printed titles.

SANTA FE COUNTY PUBLIC WORKS DEPARTMENT

OPERATIONS AND MAINTENANCE FACILITY MANUALS/ WARRANTIES

3 MASTER METERS PROJECT

VOLUME NO. __

TABLE OF CONTENTS (with subject matter of binder when multiple binders are required).

ENGINEERING COMPANY'S NAME AND PROJECT NUMBER

C. Page Dividers

1. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
2. Electronic information on the CD shall be indexed per paragraph 1.8.D., herein, and able to be searched using key words.

D. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, printed on 24 pound white paper.

3. Part 1: Directory, listing names, addresses, and telephone numbers of Contractors and major equipment suppliers.
4. Part 2: Maintenance and operating instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of Contractors and suppliers.
5. Part 3: Warranties, arranged by specification section.
6. Part 4: Software Licenses.

E. Content, for operations and maintenance instructions section for each system, as appropriate.

1. Description of System and Component Parts.
 - a. System block and interconnection diagrams.
 - b. Catalog data containing information required for service, future additions or

- substitutions.
 - c. Function, normal operating characteristics, and limiting conditions.
 - d. Performance curves, engineering data, and tests.
 - e. Complete nomenclature and commercial number of replaceable parts.
2. As-installed Color Coded Wiring Diagrams, i.e., - ladder diagrams, point to point diagrams, loop diagrams, etc.
 3. Operating Procedures
 - a. Routine and normal operating instructions.
 - b. Sequences required.
 - c. Special operating instructions.
 4. Maintenance Procedures
 - a. Routine operations.
 - b. Guide to "trouble-shooting".
 - c. Disassembly, repair, and reassembly.
 - d. Adjustment and checking.
- F. Content for Warranties Section
1. Provide notarized copies.
 2. Execute and assemble documents from Contractors, suppliers, and manufacturers.
 3. Provide Table of Contents and assemble in binder with Maintenance and Operating Instructions.
 4. For items of work delayed beyond date of final acceptance, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.
 5. Content for Software Licenses Section
 6. For each item of copyrighted software provided under this contract, provide a software license certificate naming the Albuquerque/Bernalillo County Water Utility Authority as the licensee and stating the number of licenses provided.

- G. Submit one copy of completed Maintenance and Operating Instructions to the Engineer in pre-final form 45 days prior to the Substantial Completion Inspection and prior to the pump station start-up. This copy will be returned after the Substantial Completion Inspection, with the Engineer's comments. Revise content of documents as required prior to final submittal.
- H. Submit three final copies of completed Maintenance and Operating Instructions, revised to reflect Engineer's comments, to the Engineering Representative within ten days after receipt of comments.

1.9. SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections prior to final acceptance.
- B. Deliver to project site and place in location as directed by Engineer; obtain receipt prior to final payment.

1.10. PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
 - 1. Contract Drawings.
 - 2. Specifications
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and Modifications.
- E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:

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

F. Submit documents to Engineer with final Application for Payment

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

MEASUREMENT AND PAYMENT

3.1. GENERAL

Costs for the work in this section shall be included in the Bid Item for Demobilization. No separate payments shall be made.

END OF SECTION

SECTION 03410

STRUCTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of structural precast concrete work is shown on drawings and in schedules.
- B. Structural precast concrete includes the following:
 - 1. Structural vaults.

1.03 RELATED WORK

- A. Applied finishes are specified in Specification Section 09900 Painting

1.04 QUALITY ASSURANCE

- A. Codes and standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated:
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318 "Building Code Requirements for Reinforced Concrete."
 - 3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
 - 4. Prestressed Concrete Institute MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products."
- B. Fabricator Qualifications: Firms which have from 2 to 5 years successful experience in fabrication of precast concrete units similar to units required for this project will be acceptable. Fabricator must have sufficient production capacity to produce required units without causing delay in work.

- C. Fabrication Qualifications: Produce precast concrete units at fabricating plant engaged primarily in manufacturing of similar units, unless plant fabrication or delivery to project site is impractical.
- D. If units are not produced at precast concrete fabricating plant, maintain procedures and conditions for quality control, which are equivalent to plant production.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.
- B. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection. Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units. Indicate gasket locations and permanent steel lifting anchors for removable panels.
- C. Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.
- D. Include erection procedure for precast units and sequence of erection.
- E. Provide complete design calculations prepared by a registered engineer licensed in
State where project is erected.
- F. Submit two samples 12" x 12" square for texture indicated.

1.06 DELIVERY STORAGE AND HANDLING

- A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.
- B. Deliver anchorage items, which are to be embedded in other construction before start of such work. Providing setting diagrams, templates, instructions and directions as required for installation.

PART 2 – PRODUCTS

2.01 FORMWORK

- A. Provide forms and, where required, form facing materials of metal, plastic, wood, or other acceptable material that is nonreactive with concrete and will produce required finish surfaces.
- B. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provided completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.
- C. Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, unless otherwise indicated.
- B. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- C. Welded Wire Fabric: ASTM A 185.
- D. Welded Deformed Steel Wire Fabric: ASTM A 497.
- E. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations.
 - 1. For exposed view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs, which are plastic protected (CRSI, Class 1), or stainless steel protected (CRSI, Class 2).

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III.
- B. Use only one brand and type of cement throughout the project, unless otherwise acceptable to Architect.

- C. Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
 - 1. Local aggregates not complying with ASTM C 33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to Architect.
- D. Water: Drinkable and free from foreign materials in amounts harmful to concrete and embedded steel.
- E. Air Entraining Admixture: ASTM C 260.
- F. Water-Reducing Admixture: ASTM C 494, Type A.

2.04 CONNECTION MATERIALS

- A. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A 283, Grade C.
- B. Steel Shapes: ASTM A 36.
- C. Anchor Bolts: ASTM A 307, low-carbon steel bolts, regular hexagon nuts and carbon steel washers.
- D. Finish of Steel Units: Exposed units galvanized per ASTM A 153; others painted with rust-inhibitive primer.

2.05 GROUT MATERIALS

- A. Non-Metallic Shrinkage Resistant Grout: Pre-mixed, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - Euco N.S.; Euclid Chemical Co.
 - Crystex: L&M Construction Chemicals.
 - Masterflow 71; Master Builders.
 - Five Star Grout; U.S. Grout Corp.
 - Upcon, Upco Chem. Div., USM Corp.

2.06 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type of concrete required.
- B. Design mixes may be prepared by an independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.
- C. Proportion mixes by either laboratory trail batch or field experience methods, using materials to be employed on the project for each type of concrete required, complying with ACI 318.
 - 1. Produce standard weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties.

Compressive strength: 4000 psi minimum at 28 days.
Release strength for prestressed units: 3500 psi.
 - 2. Cure compression test cylinders using same methods as used for precast concrete work.
- D. Submit written reports to Architect of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect.
- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in the work.
- F. Admixtures:
 - 1. Use air-entraining admixture in concrete, unless otherwise indicated.
 - 2. Use water-reducing admixtures in strict compliance with Manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's acceptance.
 - 3. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.07 FABRICATION

- A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations and dimensional tolerances of PCI MNL-116, and as specified for types of units required.
- B. Ready mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
 - 1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.
- C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.
 - 1. When the air temperature is between 85° F (30° C) and 90° F (32° C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90° (32° C) reducing mixing and delivery time to 60 minutes.
- D. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or placing of concrete. Do not relocate bearing plates in units unless acceptable to Architect.
- E. Cast in holes for openings larger than 10” diameter or 10” square in accordance with final shop drawings. Other smaller holes will be field cut by trades requiring them, as acceptable to Architect.
- F. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formulation formcoating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer’s instructions.
- G. Clean reinforcement of loose rust and mill scale, earth and other materials which reduce or destroy bond with concrete.
- H. 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.
- I. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold

reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

- J. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.
- K. Identification: Provide permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface which will not show in finished structure.
- L. Curing by low-pressure steam, by steam vapor, or by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.
- M. Finish of Formed Surfaces: Provides finishes for formed surfaces of precast concrete as indicated for each type of unit, and as follows:
 - 1. Standard Finish: Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted. Sandblast or deface exterior surface of wall panels to a sand finish (similar to a stucco finish) after removal from forms.
 - 2. Finish of Unformed Surfaces: Apply trowel finish to unformed surfaces unless otherwise indicated. Consolidate concrete; bring to proper level with a straightedge, float, and trowel to a smooth, uniform finish.

2.07 STRUCTURAL WALL PANELS

- A. Type: Precast concrete units produced under a rigidly inspected process.
- B. Furnish units, which are free of voids or honeycomb, with straight true edges and surfaces.
- C. Provide “Standard Finish” units as specified.
- D. Where ends of strands will not be enclosed or covered, cut flush and cover with a high strength mortar bonded with an epoxy resin-bonding agent.
- E. Fabrication: Manufacture units of concrete materials which will provide a minimum 3500 psi compressive strength at time of initial prestress and a 28-day strength of 5000 psi.

- F. Adequately reinforce units to resist transporting and handling stresses including stresses incurred during periodic removal of wall panels as indicated.
- G. Include cast-in weld plates where required for anchorage or lateral bracing to other supporting members.
- H. Cooperate with other trades for the installation of items to be cast-in precast structural framing units. Notify Contractor of items not received in ample time so as to not delay work.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Welding: Perform welding in compliance with AWS D 1.1, including qualification of welders. All welding shall be done by certified welders.
- B. Protect units from damage by field welding or cutting operations and provide non-combustible shield as required.
- C. Repair damaged metal surfaces by cleaning and applying a coat of liquid galvanizing repair compound to galvanized surfaces and compatible primer to painted surfaces.
- D. Powder-Actuated Fasteners: Do not use powder-actuated fasteners for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.
- E. Installation Tolerances: Install precast units without exceeding following tolerance limits:
 - 1. Variations from Plumb: 1/4" in any 20' run or story height; 1/2" total in any 40' or longer run.
 - 2. Variations from Level or Elevation: 1/4" in any 20' run; 1/2" in any 40' run; total plus or minus 1/2" at any location.
 - 3. Variation from Position in Plan: Plus or minus 1/2" maximum at any location.
 - 4. Offsets in Alignment of Adjacent Members at Any Joint: 1/16" in any 10' run; 1/4" maximum.
- F. Grouting Connections and Joints: After permanent precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:

1. Cement grout consisting of 1 part Portland cement, 2 1/2 parts sand, and only enough water to properly mix and for hydration.
 2. Shrinkage-resistant grout consisting of premixed compound and water to provide a flowable mixture without segregation or bleeding.
 3. Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.
- G. Caulk and seal all joints of removable panels to a watertight seal. Install manufactured recommended sealant at joints.

3.02 PLANT QUALITY CONTROL EVALUATIONS

- A. The Owner may employ a separate testing laboratory to evaluate precast manufacturer's quality control and testing methods.
- B. The precast manufacturer shall allow Owner's testing facility access to materials storage areas, concrete production equipment, and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- C. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits, will be subject to additional testing as herein specified.
- D. Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. Repair, or remove and replace rejected units as required to meet construction conditions.
- E. Strength of units: The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units including the following conditions:
1. Failure to meet compressive strength test requirements.
 2. Reinforcement, and pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.

3. Concrete curing, and protection of precast units against extremes in temperature, not as specified.
 4. Precast units damaged during handling and erection.
- F. Testing Precast Units: When there is evidence that strength of precast concrete units does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C42 and as follows:
1. Take at least 3 representative cores from precast units of suspect strength, from locations directed by Architect.
 2. Test cores in a saturated-surface-dry condition per ACI 318 if concrete will be wet during use of completed structure.
 3. Test cores in an air-dry condition per ACI 318 if concrete will be dry during use of completed structure.
 4. Strength of Concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85% of 28-day design compressive strength.
 5. Test results will be made in writing on same day that tests are made, with copies to Architect, Contractor, and precast manufacturer. Include in test reports the project identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, number, and type of member or members represented by core tests, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of testing.
- G. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.
- H. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this section: Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

PART 4 – MEASUREMENT AND PAYMENT

4.01 GENERAL

Work covered in this section of the specifications, and associated costs therewith, shall be included in the lump sum bid item to which the work applies. No separate payments shall be made.

END OF SECTION

SECTION 08650
VAULT ACCESS DOOR

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Furnishing and installing factory-fabricated vault access door, including frame, hardware, and attachments as shown on the drawings.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Doors shall be reinforced to withstand a live load of the H-20, Uniform live load with a maximum allowable deflection of 1/150 of the span.
2. Operation of the doors shall be smooth and easy with controlled operation through the entire arc of opening and closing, and shall not be adversely affected by temperature change.
3. Doors shall open to 90 degrees and automatically lock with a T-316 stainless steel hold open arms with release handles.
4. Doors shall incorporate enclosed stainless steel compression spring assists.
5. Doors shall close flush with the frame. Hinges and all fastening hardware shall be T-316 stainless steel.
6. Unit shall lock with a T-316 stainless steel slam lock with removable keys and have a non-corrosive handle.
7. Unit shall carry a lifetime guarantee against defects in material and/or workmanship.
8. Design requirements specified herein are in addition to applicable building code requirements. The more stringent requirements will govern.

1.03 SUBMITTALS

A. Shop Drawings:

1. Door unit: Show type, elevation, thickness of metals, full size profiles of door members.

2. Hardware: Show materials, finishes, locations of fasteners, types of fasteners, locations, and types of operating hardware, and details of installation.
 3. General: Show connections of unit and hardware to precast vault lid
- B. Product Data: Manufacturer's technical data for access hatch assembly, including setting drawings, templates, fire-resistive characteristics, finish requirements, and details of anchorage devices and type(s) of sealant.
1. Include type, location, construction details, finishes, latching or locking provisions, and other pertinent data.
- C. Manufacturer's installation Instructions: Indicate installation requirements and rough-in dimensions.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain access door and frame for project from one source and a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site ready to use.
- B. Exercise proper care in handling of materials so as not to injure finished surfaces. Protect work from damage after it is in place.
- C. Store materials in a dry, protected, and well-vented area off the ground. Remove materials that are damaged or otherwise not suitable for installation from job site and replace with acceptable materials at no additional cost to owner.

1.06 SEQUENCING

- A. Observe all appropriate OSHA safety guidelines for this work.

1.07 WARRANTY

- A. Provide manufacturer's written warranty.
- B. Warrant access door to be free from manufacturing defects in materials and workmanship for a period of five (5) years from the date of shipment. Should a product fail to function in normal use within this period, the manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Subject to compliance with requirements, provide products from the following manufacturers, or approved equivalent:
 - 1. Halliday Products, Heavy Duty Regular Access Door,

2.02 MATERIALS

- A. Cover: 1/4 inch (7mm) thick, one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor.
- B. Cover insulation: Shall be fiberglass, fully covered and protected by an 18-gauge aluminum metal liner.
- C. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe.
- D. All hardware shall be stainless steel.

2.03 HARDWARE

- A. Heavy pintle hinges shall be provided
- B. Covers shall be equipped with an enclosed two point spring latch with interior and exterior turn handles
- C. Unit shall lock with a T-316 stainless steel slam lock with removable keys and have a non-corrosive handle. The latch strike shall be a stamped component bolted to the curb assembly.
- D. Covers shall automatically lock in the open position with a rigid hold open arm equipped with a red vinyl grip handle to permit easy release for closing.
- E. Compression spring tubes shall be an engineered composite material. Stainless steel compression springs, Type 316 stainless steel hinges.
- F. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

2.04 FINISHES

- A. Factory finish shall be mill finish aluminum.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation. Verify affected dimensions are acceptable.
- B. Verify tolerances and correct improper conditions.

3.02 INSTALLATION

- A. Vault access door shall be cast in place during vault lid casting.
- B. The installer shall comply with the access door manufacturer's installation instructions.

3.03 CLEAN AND ADJUST

- A. Clean adjacent surfaces and remove unused product and debris from site.
- B. Adjust doors for smooth operation.

PART 4 – MEASUREMENT AND PAYMENT

Costs for the work in this Section shall be included as part of the bid amount for the Project as stated in the Bid Proposal.

END OF SECTION

SECTION 09900
PAINTING and COATING

PART 1 - GENERAL

1.01 SCOPE

- A. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
- B. Painting includes field painting exposed bare and covered pipes and ducts (including color-coding), hangers, exposed steel and ironwork, and primed metal surfaces of mechanical and electrical equipment.
- C. Metal work, together with Mechanical and Electrical Systems.
- D. Priming of damaged or abraded shop coats.
- E. Touch-up painting of all factory finishes damaged in shipment or installation and repainting if colors are not satisfactory.
- F. Interior piping, pumps, motors, valves and miscellaneous equipment.
- G. Interior and exterior building walls including complete awning assembly.
- H. Doors, transoms, louvers, doorframes, window frames, and window inserts.

1.02 WORK NOT COVERED

- A. Materials, equipment and surfaces painted or finished completely under other sections.
- B. Painting of aluminum, chromium plate, copper, bronze, brass, galvanized, or stainless steel surfaces.
- C. Finished metal surfaces.
- D. Concealed surfaces.
- E. Operating parts.
- F. Labels.

G. Light Fixtures, Switchgear, and Distribution Cabinets.

1.03 RELATED SECTIONS

A. Factory prefinished items as specified.

1.04 QUALITY ASSURANCE

A. Include on label of containers:

1. Manufacturer's name.
2. Type of paint.
3. Manufacturer's stock number.
4. Color.
5. Instructions for reducing, where applicable.

B. Sampling of Materials:

1. When requested by the Architect, furnish test samples from source of supply.
2. Furnish from materials designated by the Architect:
 - a. 5 gal. - from batches of 50 gallons or less
 - b. 10 gal. - from batches over 50 gallons

1.05 PRODUCTS DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Deliver sealed containers with labels legible and intact.

B. Storage of Materials:

1. Store only acceptable project materials on project site.
2. Store in a suitable location.
3. Restrict storage to paint materials and related equipment.
4. Comply with health and fire regulations.

1.06 JOB CONDITIONS

A. Environmental Requirements:

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating system can be applied.
2. Do not apply finish in areas where dust is being generated.
3. Lighting. Provide not less than 20 foot-candles illumination for all surfaces to be painted or coated.

B. Protection:

1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PAINTING SYSTEMS

A. For purposes of establishing quality, Sherwin Williams Industrial Maintenance Coatings Colors are used as a basis for this specification, but bids may be based on the use of these brands:

1. Wellborn
2. Deer-O-Company
3. Glidden
4. Martin-Senour Paint Company
5. Pittsburgh Paint Company
6. Pratt and Lambert Paint Company

B. All material shall be the product of one manufacturer.

C. Exterior Surfaces:

1. Block-Natural Finish: Block shall receive two coats of Sherwin Williams "Prime-a-Pell" 200.
2. Metal: Metal surfaces, except those that are galvanized or finished

with an asphaltic type protective coating, shall receive one coat of Sherwin Williams Kem Kromik Primer (B50N2/B50W1) followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).

3. Metal: Metal surface finished with an asphaltic type protective coating shall receive one coat of Sherwin Williams K1LZ Primer followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).
4. Metal: Galvanized metal surfaces shall receive one coat of Sherwin Williams Galvite Primer followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series). Or two coats of Sherwin Williams Metalastic II Enamel (B-53 Series).
5. Metal: High Gloss steel plate window inserts and acoustic louver shall receive one coat of Sherwin Williams Kem Kromik Primer (B50N2/B50W1) followed by two coats of Sherwin Williams Metalastic II Enamel (B-53 Series).

D. Interior Surfaces:

1. Block and Concrete Wall Panels: All interior block and concrete wall panel surfaces shall receive one coat of Sherwin Williams "Prime-a-Pell" 200.
2. Metal: Metal surfaces, except those that are galvanized or finished with an asphaltic type protective coating, shall receive one coat of Sherwin Williams Kem Kromik Primer (B50N2/B50W1) followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).
3. Metal: Metal surfaces finished with an asphaltic type protective coating shall receive one coat of Sherwin Williams K1LZ Primer followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).
4. Metal: Galvanized metal surfaces shall receive one coat of Sherwin Williams Galvite Primer followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).
5. Concrete: Concrete floors shall receive Tile-Clad II Epoxy non-skid coating system.

2.02 SUBMITTALS AND SUBSTITUTIONS

- A. Submit substitute paint schedules listing all surfaces and proposed products.
- B. Obtain Owner approval prior to purchase and delivery of any substitutions.

- C. Submit samples of each color and material to be applied, with texture to simulate actual condition, on representative samples of the actual substrate. Define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and textures are achieved.

2.03 MIXING AND TINTING

- A. Deliver paints and enamels ready-mixed to job site.
- B. Accomplish job mixing and job tinting only when acceptable to the Architect.
- C. Mix only in mixing pails placed in suitable sized non-ferrous or oxide resistant metal pans.
- D. Use tinting colors recommended by manufacturer for the specific type of finish.

2.04 COLOR SCHEDULE

Except as noted, the color names and numbers listed are those of Sherwin Williams. Paint shall be Industrial Enamel as manufactured by Sherwin Williams, or approved equal.

- A. Exterior Surfaces to be painted (including enclosure walls, interior and exterior):
 - 1. Miscellaneous items as directed by the Architect using the above listed colors.
- B. Interior Surfaces:
 - 1. Water Piping: Maritime Blue MC-83.
 - 2. All Drain and Wastewater Piping including valves: Spice MC-57.
 - 3. Electromagnetic Flow Meter: Safety Blue.
 - 4. Electrical Box Plate Covers: Safety Red.
 - 5. Other small miscellaneous items as directed by the Architect or Engineer using the above listed colors.

2.05 PIPING SYSTEM IDENTIFICATION

- A. Means of Identification: All piping within the Meter Vault shall be identified by each of the means described below.
- B. Piping identification shall meet the standards of the Federal Occupational Safety Health Act (OSHA), which refers to the ANSI Standard A13.1.
- C. Inside or weather-protected piping systems shall be identified by means of an identifying legend on color background appropriately worded to indicate the "service" name of the pipe as shown on the Drawings.
 - 1. Labels shall be Seton - CODE STANDARD MARKERS, Styles CC, EE, FF, properly sized to fit the pipe being labeled.
 - 2. Each pressure-sensitive label shall be applied to clean, dry pipe or insulation.
 - 3. The applied label shall then be banded on both ends using SETON-ARROWS-ON-A-ROLL TAPE of the same color as the label. The banding shall wrap completely around the pipe or insulation and shall overlap for a secure bond. The arrows on the band shall indicate the direction of flow in the piping system.
- D. Locations of Piping System Identification: The identifying legend and directional arrows described in the paragraphs preceding shall be located at the following points on each piping system:
 - 1. Adjacent to each valve in piping system
 - 2. At every point of entry and exit where piping passes through a wall.
 - 3. At a maximum interval of 20 feet on pipelines exposed and concealed above accessible ceilings.
 - 4. Adjacent to all special fittings (regulating valves, etc.) in piping systems.
 - 5. At every access door.
- E. Attach pipe markers to lower quarter of the pipe on horizontal runs located 4' above finish floor, to upper quarter on horizontal runs located less than 4' above finish floor and within buried vaults, and on the centerline of vertical piping where view is not obstructed.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which

cannot be put into an acceptable condition through preparatory work as included in Article 3.02, PREPARATION OF SURFACES.

- B. Do not proceed with surface preparation or coating application until conditions are suitable. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.02 PREPARATION OF SURFACES

- A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operation in each space or area, have items reinstalled by workers skilled in the trades involved.
- B. Ferrous Metal Surfaces:
 - 1. Prepare surface in accordance with recommendations or directions of manufacturer.
- C. Galvanized Metal:
 - 1. Clean surfaces with mineral spirits to remove oily residue.
 - 2. Dry with clean cloth.
- D. Concrete Surfaces:
 - 1. Prepare surface in accordance with recommendations or directions of manufacturer.

3.03 APPLICATION

- A. General Requirements:
 - 1. Environment:
 - a. Do not apply coating until moisture content of surface is within limitations recommended by paint manufacturer. Do not apply coating in damp, rainy weather.
 - b. Do not apply coating when temperature is below 50 degrees F.
 - c. Do not apply coating when dust conditions prevent favorable workmanship.

2. Apply paint with suitable brushes, rollers, or spraying equipment.
 - a. Rate of application shall not exceed that as recommended by paint manufacturer for the surface involved less 10% allowance for losses.
 - b. Keep brushes, rollers, and spraying equipment clean, dry, free from contaminates and suitable for the finish required.
3. Comply with recommendation of product manufacturer for drying time between succeeding coats.
4. Vary slightly the color of successive coats.
5. Sand and dust between each coat to remove defects visible from a distance of 5 feet.
6. Finish coats shall be smooth, free of brush marks, streaks, laps or pile-up of paints, and skipped or missed areas.
7. Inspection:
 - a. Do not apply additional coats until completed coat has been inspected by the Architect.
 - b. Only inspected coats of paint will be considered in determining number of coats applied.
8. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.

3.04 CLEANING

- A. Touch up and restore finish where damaged.
- B. Remove spilled, splashed, or splattered paint from all surfaces.
- C. Do not mar surface finish of item being cleaned.

PART 4 – MEASUREMENT AND PAYMENT

Costs for the work in this Section shall be included as part of the bid amount for the Project as stated in the Bid Proposal.

END OF SECTION

SECTION 09900
PAINTING and COATING

PART 1 - GENERAL

1.01 SCOPE

- A. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
- B. Painting includes field painting exposed bare and covered pipes and ducts (including color-coding), hangers, exposed steel and ironwork, and primed metal surfaces of mechanical and electrical equipment.
- C. Metal work, together with Mechanical and Electrical Systems.
- D. Priming of damaged or abraded shop coats.
- E. Touch-up painting of all factory finishes damaged in shipment or installation and repainting if colors are not satisfactory.
- F. Interior piping, pumps, motors, valves and miscellaneous equipment.
- G. Interior and exterior building walls including complete awning assembly.
- H. Doors, transoms, louvers, doorframes, window frames, and window inserts.

1.02 WORK NOT COVERED

- A. Materials, equipment and surfaces painted or finished completely under other sections.
- B. Painting of aluminum, chromium plate, copper, bronze, brass, galvanized, or stainless steel surfaces.
- C. Finished metal surfaces.
- D. Concealed surfaces.
- E. Operating parts.
- F. Labels.

G. Light Fixtures, Switchgear, and Distribution Cabinets.

1.03 RELATED SECTIONS

A. Factory prefinished items as specified.

1.04 QUALITY ASSURANCE

A. Include on label of containers:

1. Manufacturer's name.
2. Type of paint.
3. Manufacturer's stock number.
4. Color.
5. Instructions for reducing, where applicable.

B. Sampling of Materials:

1. When requested by the Architect, furnish test samples from source of supply.
2. Furnish from materials designated by the Architect:
 - a. 5 gal. - from batches of 50 gallons or less
 - b. 10 gal. - from batches over 50 gallons

1.05 PRODUCTS DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Deliver sealed containers with labels legible and intact.

B. Storage of Materials:

1. Store only acceptable project materials on project site.
2. Store in a suitable location.
3. Restrict storage to paint materials and related equipment.
4. Comply with health and fire regulations.

1.06 JOB CONDITIONS

A. Environmental Requirements:

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating system can be applied.
2. Do not apply finish in areas where dust is being generated.
3. Lighting. Provide not less than 20 foot-candles illumination for all surfaces to be painted or coated.

B. Protection:

1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PAINTING SYSTEMS

A. For purposes of establishing quality, Sherwin Williams Industrial Maintenance Coatings Colors are used as a basis for this specification, but bids may be based on the use of these brands:

1. Wellborn
2. Deer-O-Company
3. Glidden
4. Martin-Senour Paint Company
5. Pittsburgh Paint Company
6. Pratt and Lambert Paint Company

B. All material shall be the product of one manufacturer.

C. Exterior Surfaces:

1. Block-Natural Finish: Block shall receive two coats of Sherwin Williams "Prime-a-Pell" 200.
2. Metal: Metal surfaces, except those that are galvanized or finished

with an asphaltic type protective coating, shall receive one coat of Sherwin Williams Kem Kromik Primer (B50N2/B50W1) followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).

3. Metal: Metal surface finished with an asphaltic type protective coating shall receive one coat of Sherwin Williams K1LZ Primer followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).
4. Metal: Galvanized metal surfaces shall receive one coat of Sherwin Williams Galvite Primer followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series). Or two coats of Sherwin Williams Metalastic II Enamel (B-53 Series).
5. Metal: High Gloss steel plate window inserts and acoustic louver shall receive one coat of Sherwin Williams Kem Kromik Primer (B50N2/B50W1) followed by two coats of Sherwin Williams Metalastic II Enamel (B-53 Series).

D. Interior Surfaces:

1. Block and Concrete Wall Panels: All interior block and concrete wall panel surfaces shall receive one coat of Sherwin Williams "Prime-a-Pell" 200.
2. Metal: Metal surfaces, except those that are galvanized or finished with an asphaltic type protective coating, shall receive one coat of Sherwin Williams Kem Kromik Primer (B50N2/B50W1) followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).
3. Metal: Metal surfaces finished with an asphaltic type protective coating shall receive one coat of Sherwin Williams K1LZ Primer followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).
4. Metal: Galvanized metal surfaces shall receive one coat of Sherwin Williams Galvite Primer followed by two coats of Sherwin Williams Industrial Enamel (B-54 Series).
5. Concrete: Concrete floors shall receive Tile-Clad II Epoxy non-skid coating system.

2.02 SUBMITTALS AND SUBSTITUTIONS

- A. Submit substitute paint schedules listing all surfaces and proposed products.
- B. Obtain Owner approval prior to purchase and delivery of any substitutions.

- C. Submit samples of each color and material to be applied, with texture to simulate actual condition, on representative samples of the actual substrate. Define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and textures are achieved.

2.03 MIXING AND TINTING

- A. Deliver paints and enamels ready-mixed to job site.
- B. Accomplish job mixing and job tinting only when acceptable to the Architect.
- C. Mix only in mixing pails placed in suitable sized non-ferrous or oxide resistant metal pans.
- D. Use tinting colors recommended by manufacturer for the specific type of finish.

2.04 COLOR SCHEDULE

Except as noted, the color names and numbers listed are those of Sherwin Williams. Paint shall be Industrial Enamel as manufactured by Sherwin Williams, or approved equal.

- A. Exterior Surfaces to be painted (including enclosure walls, interior and exterior):
 - 1. Miscellaneous items as directed by the Architect using the above listed colors.
- B. Interior Surfaces:
 - 1. Water Piping: Maritime Blue MC-83.
 - 2. All Drain and Wastewater Piping including valves: Spice MC-57.
 - 3. Electromagnetic Flow Meter: Safety Blue.
 - 4. Electrical Box Plate Covers: Safety Red.
 - 5. Other small miscellaneous items as directed by the Architect or Engineer using the above listed colors.

2.05 PIPING SYSTEM IDENTIFICATION

- A. Means of Identification: All piping within the Meter Vault shall be identified by each of the means described below.
- B. Piping identification shall meet the standards of the Federal Occupational Safety Health Act (OSHA), which refers to the ANSI Standard A13.1.
- C. Inside or weather-protected piping systems shall be identified by means of an identifying legend on color background appropriately worded to indicate the "service" name of the pipe as shown on the Drawings.
 - 1. Labels shall be Seton - CODE STANDARD MARKERS, Styles CC, EE, FF, properly sized to fit the pipe being labeled.
 - 2. Each pressure-sensitive label shall be applied to clean, dry pipe or insulation.
 - 3. The applied label shall then be banded on both ends using SETON-ARROWS-ON-A-ROLL TAPE of the same color as the label. The banding shall wrap completely around the pipe or insulation and shall overlap for a secure bond. The arrows on the band shall indicate the direction of flow in the piping system.
- D. Locations of Piping System Identification: The identifying legend and directional arrows described in the paragraphs preceding shall be located at the following points on each piping system:
 - 1. Adjacent to each valve in piping system
 - 2. At every point of entry and exit where piping passes through a wall.
 - 3. At a maximum interval of 20 feet on pipelines exposed and concealed above accessible ceilings.
 - 4. Adjacent to all special fittings (regulating valves, etc.) in piping systems.
 - 5. At every access door.
- E. Attach pipe markers to lower quarter of the pipe on horizontal runs located 4' above finish floor, to upper quarter on horizontal runs located less than 4' above finish floor and within buried vaults, and on the centerline of vertical piping where view is not obstructed.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which

cannot be put into an acceptable condition through preparatory work as included in Article 3.02, PREPARATION OF SURFACES.

- B. Do not proceed with surface preparation or coating application until conditions are suitable. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.02 PREPARATION OF SURFACES

- A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operation in each space or area, have items reinstalled by workers skilled in the trades involved.
- B. Ferrous Metal Surfaces:
 - 1. Prepare surface in accordance with recommendations or directions of manufacturer.
- C. Galvanized Metal:
 - 1. Clean surfaces with mineral spirits to remove oily residue.
 - 2. Dry with clean cloth.
- D. Concrete Surfaces:
 - 1. Prepare surface in accordance with recommendations or directions of manufacturer.

3.03 APPLICATION

- A. General Requirements:
 - 1. Environment:
 - a. Do not apply coating until moisture content of surface is within limitations recommended by paint manufacturer. Do not apply coating in damp, rainy weather.
 - b. Do not apply coating when temperature is below 50 degrees F.
 - c. Do not apply coating when dust conditions prevent favorable workmanship.

2. Apply paint with suitable brushes, rollers, or spraying equipment.
 - a. Rate of application shall not exceed that as recommended by paint manufacturer for the surface involved less 10% allowance for losses.
 - b. Keep brushes, rollers, and spraying equipment clean, dry, free from contaminates and suitable for the finish required.
3. Comply with recommendation of product manufacturer for drying time between succeeding coats.
4. Vary slightly the color of successive coats.
5. Sand and dust between each coat to remove defects visible from a distance of 5 feet.
6. Finish coats shall be smooth, free of brush marks, streaks, laps or pile-up of paints, and skipped or missed areas.
7. Inspection:
 - a. Do not apply additional coats until completed coat has been inspected by the Architect.
 - b. Only inspected coats of paint will be considered in determining number of coats applied.
8. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.

3.04 CLEANING

- A. Touch up and restore finish where damaged.
- B. Remove spilled, splashed, or splattered paint from all surfaces.
- C. Do not mar surface finish of item being cleaned.

PART 4 – MEASUREMENT AND PAYMENT

Costs for the work in this Section shall be included as part of the bid amount for the Project as stated in the Bid Proposal.

END OF SECTION

SECTION 09954
POLYETHYLENE SHEET ENCASUREMENT (AWWA C105)

PART 1 – GENERAL

1.01 DESCRIPTION

This section includes materials and installation of a polyethylene sheet encasement for buried ductile iron pipe, fittings, and valves.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Specification Section 15240: DUCTILE IRON PIPE.
- B. APWA Specification Section 801: INSTALLATION OF WATER TRANSMISSION, COLLECTOR AND DISTRIBUTION LINES

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300: CONTRACTOR SUBMITTALS.
- B. Submit manufacturer's catalog literature and product data sheets describing the physical, chemical, and electrical properties of the encasement material.

PART 2 – PRODUCTS

2.01 POLYETHYLENE WRAP

The encasement shall consist of a polyethylene wrap at least 8 mils thickness conforming to AWWA C105. Color: Black.

2.02 PLASTIC ADHESIVE TAPE

Tape shall be Calpico Polyvinyl Tape, Polyken 900, Scotchwrap 50, or equal.

PART 3 – EXECUTION

3.01 APPLYING SHEET COATING TO BURIED PIPING AND FITTINGS

- A. Apply wrapping per AWWA C105.
- B. Apply a single wrapping.
- C. Overlap adjoining polyethylene tube coatings a minimum of 1 foot and wrap prior to placing concrete anchors, collars, supports, or thrust blocks. Hand wrap the polyethylene sheet, apply two layers, and secure in place with 2-inch-wide polyethylene adhesive tape.

3.02 APPLYING SHEET COATING TO BURIED VALVES

Wrap with a flat sheet of polyethylene. Place the sheet under the valve and the flanges or joints with the connecting pipe and fold in half. Extend the sheet to the valve stem and secure the sheet in place with 2-inch-wide plastic adhesive tape. Apply a second layer and secure with tape. Secure the sheets with tape around the valve stem below the operating nut and around the barrel of the connecting pipe to prevent the entrance of soil. Pour concrete anchor and support blocks after the wrap has been placed.

3.03 APPLYING SHEET COATING TO BURIED FLEXIBLE PIPE COUPLINGS

Apply two layers or wraps around the coupling. Overlap the adjoining pipe or fitting a minimum of 1 foot and secure in place with tape. Apply tape around the entire circumference of the overlapped section on the adjoining pipe or fitting.

3.04 REPAIR OF POLYETHYLENE MATERIAL

Repair polyethylene material that is damaged during installation. Use polyethylene sheet, place over damaged or torn area, and secure in place with 2-inch-wide plastic adhesive tape.

PART 4 – PAYMENT

Payment for the work in this section shall not be paid for separately, but shall be included as part of the unit price cost for piping. No additional compensation will be made.

END OF SECTION

SECTION 09955
COLD APPLIED WAX TAPE COATING

PART 1 - GENERAL

1.01 WORK INCLUDED IN THIS SECTION

The work of this Section includes materials and application of a three part, cold applied wax tape coating system for buried piping. The coating system shall be in accordance with AWWA C217 and as modified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Specification Section 09954: POLYETHYLENE SHEET ENCASMENT (AWWA C105)

1.03 SUBMITTALS

The following shall be submitted in compliance with Specification Section 01300: CONTRACTOR SUBMITTALS:

- A. Manufacturer's catalog data sheets.
- B. Manufacturer's application instructions.

PART 2 - PRODUCTS

2.01 PRIMER

- A. Primer shall be a blend of petroleum, plasticizer, and corrosion inhibitors having a paste-like consistency. The primer shall have the following properties:

- 1. Pour Point 100°F to 110°F
- 2. Flash Point 350°
- 3. Coverage 1 gallon/100 square feet

- B. Primer shall be Trenton Wax Tape Primer, Dense Paste Primer, or equal.

2.02 WAX TAPE

- A. Wax tape shall consist of a synthetic-fiber felt, saturated with a blend of microcrystalline wax, petroleum, plasticizer, and corrosion inhibitors, forming a tape coating that is easily formable over irregular surfaces. The tape shall have the following properties:

- | | |
|------------------------|----------------|
| 1. Saturant Pour Point | 115°F to 120°F |
| 2. Thickness | 50 to 70 mils |
| 3. Tape Width | 6 inches |
| 4. Dielectric Strength | 100 volts/mil |

B. Wax tape shall be Trenton No. 1 Wax Tape, Denso “Densyl Tape,” or equal.

2.03 PLASTIC WRAPPER

A. Wrapper shall be a polyvinylidene chloride plastic with three 50-gauge plies wound together as a single sheet. The wrapper shall have the following properties:

- | | |
|---------------|----------|
| 1. Color | Clear |
| 2. Thickness | 1.5 mils |
| 3. Tape Width | 6 inches |

B. Plastic wrapper shall be Trenton Poly-Ply, Denso Tape PVC Self Adhesive, or equal.

PART 3 - EXECUTION

3.01 WAX TAPE COATING APPLICATION

- A. Surfaces shall be clean and free of all dirt, grease, water, and other foreign material prior to the application of the primer and wax tape.
- B. Primer shall be applied by hand or brush to all surfaces of the pipe, fitting, flanges, and bolts to be wrapped by wax tape. The primer shall be worked into all crevices, around bolts and nuts, into the threads, and shall completely cover all exposed metal surfaces. The primer shall be extended beyond the indicated limits of application a minimum of 3 inches onto adjacent surfaces of the piping.
- C. Wax tape shall be applied immediately after the primer application. The tape shall be worked into the crevices around the fitting or flanges. Short lengths of tape shall be cut, placed over each bolt head and nut, and worked into the crevices. The wax tape shall be wrapped spirally around the pipe and across the fitting or flanges to a minimum of 6 inches beyond each side of the item being installed. A minimum overlap of 55 percent of the tape width shall be used.
- D. The tape shall be worked into the crevices and contours of irregularly shaped surfaces and smoothed out so that there is a continuous protective layer with no voids or spaces under the tape.
- E. The completed wax tape coating installation shall be overlapped with the plastic wrapping material. Wrap spirally around the pipe and across the fitting or flanges. Use a minimum overlap of 55 percent of the tape width and apply two layers or applications of overwrap. Plastic wrapper shall be secured to pipe with adhesive tape.

3.02 POLYETHYLENE ENCASEMENT

Completed wax tape coating system shall be wrapped with polyethylene sheet per Specification Section 09954: POLYETHYLENE SHEET ENCASEMENT (AWWA C105) and secured around the adjacent pipe circumference with adhesive tape.

PART 4 – MEASUREMENT AND PAYMENT

Payment for the work in this section shall not be paid for separately, but shall be included in the various items of work to which it pertains and no additional compensation will be made therefor.

END OF SECTION

SECTION 09961
FUSION BONDED EPOXY LININGS AND COATINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials, application, and testing of one part, fusion bonded, heat cured, thermosetting, 100 percent solids epoxy linings and coatings on steel, cast iron and ductile iron equipment, such as valves, flexible pipe couplings, slide gates, and steel pipe.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Specification Section 09900: Painting

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the Specification Section 01300: Contractor's Submittals.
- B. Submit manufacturer's catalog literature and product data sheets, describing the physical and chemical properties of the epoxy coating. Describe application and curing procedure.
- C. Submit coating application test records for measuring coating thickness and holiday detection for each item or pipe section and fitting. Describe repair procedures used.

PART 2 - PRODUCTS

2.01 PIPING AND EQUIPMENT SURFACES

- A. The Contractor shall require the equipment suppliers to provide equipment that is free of salts, oil, and grease to the coating applicator.
- B. The contractor shall require pipe suppliers to provide bare pipe that is free of salts, oil, and grease to the coating applicator.

2.02 SHOP-APPLIED EPOXY LINING AND COATING

Lining and coating shall be a 100% solids, thermosetting, fusion bonded dry powder epoxy resin: Scotchkote 134 or 206N, Lilly Powder Coatings "Pipeclad 1500 Red," H. B. Fuller 1f-3003, or equal. Epoxy lining and coating shall meet or exceed the following requirements:

Hardness (minimum) Barcol 17 (ASTM D 2583)

Rockwell 50 ("M" Scale)

Abrasion Resistance 1,000 cycles: 0.05 gram removed

(Maximum value) 5,000 cycles: 0.115 gram removed

ASTM D 1044, Tabor CS 17 Wheel,

1,000-gram weight

Tensile Strength 7,300 psi (ASTM D 2370)

Penetration 0 mil (ASTM G17)

Adhesion Overlap 4,300 psi, ASTM D 1002

Shear, 1/8 inch

Steel panel, 0.010

Glue line

Impact (minimum 100 inch-pounds (Gardner 5/8-inch

Value) diameter tup)

2.03 FIELD-APPLIED EPOXY COATING FOR PATCHING

Line and coat couplings the same as pipe. Color shall match the color of the pipe fusion epoxy coating.

PART 3 - EXECUTION

3.01 SHOP APPLICATION OF FUSION-BONDED EPOXY LININGS AND COATING GENERAL

- A. Grind surface irregularities, welds, and weld splatter smooth before applying the epoxy. The allowable grind area shall not exceed 0.25 square foot per location, and the maximum total grind area shall not exceed 1 square foot per item or piece of

equipment. Do not use any item, pipe or piece of equipment in which these requirements cannot be met

- B. Remove surface imperfections, such as slivers, scales, burrs, weld spatter, and gouges. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of ¼ inch.
- C. Uniformly preheat the pipe, item, or piece of equipment prior to blast cleaning to remove moisture from the surface. The preheat shall be sufficient to ensure that the surface temperature is at least 5 degrees F above the dew point temperature during blast cleaning and inspection.
- D. Sandblast surfaces per SSPC SP-5. Protect beveled pipe ends from the abrasive blast cleaning.
- E. After cleaning and surface penetration, test the surface for residual chloride concentration. If the residual chloride concentration exceeds 5 µg/cm², then apply a phosphoric acid wash to the surface after sandblasting. Apply a phosphoric acid wash to the pipe, item, or piece of equipment after sandblasting. The average temperature measured in three different locations, shall be 80 degrees F to 130 degrees F during the acid wash procedure. The acid wash shall be 5% by weight phosphoric acid solution. The duration in which the acid is in contact with the surface shall be determined by using the average temperature as tabulated below:

SURFACE TEMPERATURE (°f)	CONTACT TIME (SECONDS)
80	52
85	45
90	36
95	33
100	28
105	24
110	21
130	10

After the acid wash has been completed, remove the acid with demineralized water having a maximum conductivity of 5 micromhos/cm at a minimum nozzle pressure of 2,500 psi.

- F. Apply lining and coating by the electrostatic spray or fluidized bed process. Minimum thickness of lining or coating shall be 15 mils. Heat and cure per the manufacturer's recommendations. The heat source shall not leave a residue or contaminant on the metal surface. Do not allow oxidation of surfaces to occur prior to coating. Do not permit surfaces to flash rust before coating.

3.02 SHOP APPLICATION OF FUSION-BONDED EPOXY LINING AND COATING TO PIPE—ADDITIONAL REQUIREMENTS

- A. Apply lining and coating per AWWA C213 except as modified herein.
- B. Grind 0.020 inch (minimum) off the weld caps on the pipe weld seams before beginning the surface preparation and heating of the pipe.

3.03 QUALITY OF LINING AND COATING APPLICATIONS

The cured lining or coating shall be smooth and glossy, with no graininess or roughness. The lining or coating shall have no blisters, cracks, bubbles, underfed voids, mechanical damage, discontinuities, or holidays.

3.04 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

- A. Test linings and coatings with a low-voltage wet sponge holiday detector. Test pipe linings and coatings per AWWA C213, Section 5.3.3. If the number of holidays or pinholes is less than one per 20 square feet of coating surface, repair the holidays and pinholes by applying the coating manufacturer's recommended patching compound to each holiday or pinhole and retest. If the number of pinholes and holidays exceeds one per 20 square feet of coating surface, remove the entire lining or coating and recoat the item or pipe.
- B. Measure the coating thickness at three locations on each item or piece of equipment or pipe section using a coating thickness gauge calibrate at least once per eight-hour shift. Record each measured thickness values are less than the specified minimum thickness, measure the coating thickness at three additional points around the defective area. The average of these measurements shall exceed the specified minimum thickness value, and no individual thickness value shall be more than 2 mils below the specified minimum value. If a section of the pipe, item, or piece of equipment does not meet these criteria, remove the entire lining or coating, and recoat the entire item or piece of equipment.

3.05 FIELD REPAIRS

Patch scratches and damaged areas incurred while installing fusion bonded epoxy coated items with a two component, 80% solids (minimum), liquid epoxy resin.

Wire brush or sandblast the damaged areas per SSPC SP-10. Lightly abrade or sandblast the coating or lining on the sides of the damages area before applying the liquid epoxy coating. Apply a two-part epoxy coating to defective linings and coatings to areas smaller than 20 square inches. Patches areas shall overlap the parent or base coating a minimum of 0.5 inch. If a defective area exceeds 20 square inches, remove the entire lining and coating and recoat the entire pipe, item, or piece of equipment. Apply the liquid epoxy coating to a minimum dry-film thickness of 15 mils.

PART 4 – MEASUREMENT AND PAYMENT

4.01 GENERAL

Work covered in this section of the specifications, and associated costs therewith, shall be included in the lump sum bid item to which the work applies. No separate payment shall be made.

END OF SECTION

SECTION 11400
ELECTROMAGNETIC FLOW METER

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section covers the furnishing, installation, and services for an electromagnetic flow meter. The use of a Badger M-Series M-2000 electromagnetic flow meter for this application has been requested by the SDCW. Substitutions are NOT ALLOWED for this product.

1.02 RELATED WORK

- A. None.

1.03 SUBMITTALS

- A. Refer to Section 01300: Submittals

1.06 MAINTENANCE AND TEST EQUIPMENT

- A. Provide the following complete with carrying cases, patch cords, etc.
 - 1. One hand held smart transmitter calibrator provided with the flow meter to calibrate the Badger flow meters.

PART 2 PRODUCTS

2.01 FLOW METERING INSTRUMENTS

- A. Electromagnetic Flowmeter
 - 1. Flow Element
 - a. Type:
 - (1) Insertable electromagnetic type and shall provide an induced voltage proportional to the liquid flow rate.
 - b. Functional/Performance:
 - (1) Accuracy - Plus or minus 0.25 percent of rate for velocities greater than 1.64 ft/s (0.50 m/s). Plus or minus 0.004 ft/s (plus or minus 1 mm/s) for velocities less than 1.64 ft/s (0.50 m/s)
 - (2) Repeatability - Plus or minus 0.1 percent of the actual value over the flow range.
 - (3) Ambient Temperature - -4 to 140 degrees F (-20 – 60 degrees C).
 - (4) Pressure rating – Flanges shall be tested to 50% above their stated pressure rating for 150 lb flanges.
 - (5) Additional- Meter shall be capable of running empty indefinitely without damage to any component.
 - (6) The flow tube will be water submergence rated.

- c. Physical:
 - (1) Insertion hardware: 316 stainless steel.
 - (2) Flanges: ANSI 150 lb, RF cast steel unless otherwise indicated.
 - (3) Amplifier Housing - cast aluminum, powder-coated paint.
 - (4) Detector Housing – Carbon steel welded
 - d. Accessories/Options Required:
 - (1) Factory calibration - All meters shall be factory calibrated. A copy of the report shall be in the O&M manual.
 - (2) Grounding - Meter shall be grounded per the manufacturers recommendation. Provide ground ring, ground wires, gaskets, etc., as required, or as otherwise noted. All materials shall be suitable for water.
 - (3) Provide all equipment necessary for full operation of flow meter and connections to process PLC.
2. Converter/Transmitter:
- a. Input Power: 120 VAC. Optional 10-36V DC.
 - b. Output Signal: 4-20 mA proportional to flowrate over specified range.
 - c. Analog Output: Maximum loop resistance < 800Ohms.
 - d. Totalizer: Programmable/resettable.
 - e. Integral digital indicator scaled in process units.
 - h. Electrical Connections: Screw terminals for instrument cable.
3. Manufacturer:
- a. Badger Meter M-Series M2000. NO SUBSTITUTION ALLOWED

PART 3 EXECUTION

3.01 GENERAL

- A. The Badger Meter M-Series M2000 shall be installed within the Flow Meter Vault per the manufacturer's instructions. The display transmitter unit will be remotely mounted exterior to the Flow Meter Vault.
- B. A single, un-spliced, line shall be installed from the flow meter tube in the pit to the flow meter transmitter. The CONTRACTOR shall verify the length of this line prior to ordering the material.
- C. The flow meter display shall report two readings including 1) flowrate measured in gallons per minute (gpm) and 2) Total Cumulative Flow measured in Cubic Feet.

PART 4 – MEASUREMENT AND PAYMENT

- 4.01 Costs for the work in this Section shall not be paid for separately, but shall be considered incidental to the construction.

END OF SECTION

SECTION 15050
GENERAL PIPING REQUIREMENTS

PART 1 – GENERAL

1.01 DESCRIPTION

This section describes the general requirements for selecting piping materials; selecting the associated bolts, nuts, and gaskets for flanges for the various piping services in the project; and miscellaneous piping items.

1.02 SUBMITTALS

- A. Submit shop drawings in accordance Section 01300: CONTRACTOR SUBMITTALS.
- B. Submit affidavit of compliance with referenced standards (e.g., AWWA, ANSI, ASTM, etc.).
- C. Submit certified copies of mill test reports for bolts and nuts, including coatings if specified. For materials originating outside of the United States, provide recertification by an independent domestic testing laboratory.
- D. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.
- E. Submit manufacturer's data sheet for insulating unions, showing recommended installation procedures.

1.03 DEFINITIONS OF BURIED AND EXPOSED PIPING

- A. Buried piping is piping buried in the soil, commencing at the wall or beneath the slab of a structure. Where a coating is specified either on the plans or other Supplemental Specifications, provide the coating up to the structure wall (unless otherwise noted on the plans). Do not coat buried piping encased in concrete.
- B. Exposed piping is piping in any of the following conditions or locations:
 - 1. Above ground.
 - 2. Inside buildings, vaults, or other structures.
 - 3. In underground concrete trenches or galleries.

1.04 DEFAULT PIPING MATERIALS

If no material is shown in the drawings, use the following piping materials:

Service	Size Range (inches)	Material	Specification Section
Buried	3 and smaller	Copper-Type K	802
	4	PVC (AWWA C900)	801
	6 and larger	DIP	15240
Exposed	3 and smaller	Copper-Type L Hard Drawn	802
	4	DIP	801
	6 and larger	DIP	15240

PART 2 – MATERIALS

2.01 MATERIALS SELECTION AND ALTERNATIVE MATERIALS

The drawings may show alternative piping materials for certain services. In such cases, the same pipe material shall be used for all pipe sizes in all locations for the given piping service. Do not intermix piping materials.

NOTE: If used, brass components shall have no lead.

2.02 THREAD FORMING FOR STAINLESS STEEL BOLTS

Form threads by means of rolling, not cutting or grinding.

2.03 BOLTS AND NUTS FOR FLANGES FOR STEEL AND DUCTILE IRON PIPING

- A. Bolts and nuts for Class 150 flanges (including AWWA C207, Class D) located indoors and in vaults and structures shall be carbon steel, ASTM A 307, Grade B.
- B. Bolts and nuts for buried or submerged Class 150 flanges shall be Type 304 stainless steel conforming to ASTM A 193 (Grade B8) for bolts and ASTM A 194 (Grade 8) for nuts.
- C. Hex head machine bolts for use with lugged valves shall comply with ASTM A 193, Grade B7.
- D. Fit shall be Classes 2A or 2B per ANSI B1.1 when connecting to cast-iron valves having body bolt holes.
- E. Bolts for AWWA C207 Classes E and F flanges and ANSI B16.5 and B16.47 Class 300 flanges located indoors, and in vaults and structures shall be chrome molybdenum conforming to ASTM A 193, Grade B7, with nuts conforming to ASTM A 194, Grade 2H.

- F. Bolts and nuts for buried or submerged Class 300 flanges and Class 300 flanges shall be Type 304 stainless steel conforming to ASTM A 193, Grade 8, Class 2, for bolts and ASTM A 194, Grade 8 for nuts.
- G. Bolts used in flange insulation kits shall conform to ASTM A 193 (Grade B8). Nuts shall conform to ASTM A 194 (Grade 8).
- H. Provide washers for each nut and each bolt. Washers shall be of the same material as the nuts.

2.04 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

Lubricant shall be chloride free and shall be TRX-Synlube by Ramco, Anti-Seize by Ramco, Husk-It Husky Lube O'Seal, or equal.

2.05 GASKETS FOR FLANGES FOR STEEL PIPING IN WATER SERVICE (SPECIFICATION SECTION 127: STEEL WATER PIPE)

- A. Gaskets for flat face and raised face flanges shall be 1/8-inch thick and shall be one of the following nonasbestos materials:
 1. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal. Gaskets shall be suitable for a pressure of 500 psi at a temperature of 400°F.

2.06 GASKETS FOR FLANGES FOR DUCTILE-IRON PIPING AND FITTINGS IN WATER SERVICE

Gaskets shall be full face, 1/8-inch thick, cloth-inserted rubber, with a Shore "a" hardness of 75 to 85. Gaskets shall be suitable for a water pressure of 200 psi at a temperature of 180°F. Gaskets shall have "nominal" pipe size inside diameters not the inside diameters per ANSI B16.21. Products: Garlock style 19 or equal.

2.07 THREADED CAPS FOR PROTECTION OF NUTS AND BOLT THREADS

Caps shall be high-density polyethylene, color gray. The caps shall be filled with an anticorrosive lubricant to prevent nuts and bolts from rusting and corroding. Lubricant shall be suitable for use in potable water. Caps shall withstand temperatures from -40°F to 200°F. Caps shall be suitable to use in exposed, buried, and submerged service conditions. Products: Sap-Seal Products, Inc.; Advance Products and Systems, Inc., "Radolid"; or equal.

2.09 HEAT SHRINKABLE SLEEVES

Heat shrinkable sleeves when used shall comply with AWWA C216.

PART 3 – EXECUTION

3.01 RAISED FACE AND FLAT FACE FLANGES

Where a raised face flange connects to a flat-faced flange, remove the raised face of the flange.

3.02 INSTALLING ABOVE GROUND OR EXPOSED PIPING

Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment.

3.03 INSTALLING FLANGED PIPING

- A. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within 1/16 inch per foot measured across any diameter. Align flange boltholes within 1/8-inch maximum offset.
- B. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing, lubricate carbon steel bolts with oil and graphite, and tighten nuts uniformly and progressively.
- C. Bolt lengths shall extend completely through their nuts by at least one complete thread for complete engagement. Any that fail to do so shall be considered unacceptable.
- D. Do not use more than one gasket between contact faces in assembling a flanged joint.
- E. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.
- F. Install heat shrinkable sleeves, cold applied wax tape, or threaded nut and bolt thread protection caps after completing the bolt, nut, and gasket installation as set forth herein. Install on buried and submerged piping.

3.04 INSTALLING BLIND FLANGES

- A. At outlets not indicated to be connected to valves or to other pipes and to complete the installed pipeline hydrostatic test, provide blind flanges with bolts, nuts, and gaskets.
- B. Coat the inside face of blind flanges.

3.05 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant as specified in Article 2.04 herein.

PART 4 – MEASUREMENT AND PAYMENT

Payment for the work in this section shall not be paid for separately, but shall be included as part of the several unit prices and or lump sum amounts to which the work pertains to as stated in the Bid Proposal and no additional compensation will be made therefor.

END OF SECTION

SECTION 15122
FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of flexible gasketed sleeve-type compression pipe couplings for steel pipe and couplings for connecting different pipe materials.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Specification Section 09900: PAINTING AND COATING.
- B. Specification Section 15050: GENERAL PIPING REQUIREMENTS.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Specification Section 01300: CONTRACTOR SUBMITTALS.
- B. Submit manufacturer's catalog data on flexible pipe couplings. Show manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings and joints are used. Show coatings.
- C. Submit manufacturer's recommended torques to which the coupling bolts shall be tightened for the flexible gasketed sleeve-type compression pipe couplings.
- D. Show materials of construction by ASTM reference and grade. Show dimensions.
- E. Show number, size, and material of construction of tie rods and lugs for each thrust harness on the project.

PART 2 - MATERIALS

2.01 COUPLING SYSTEM DESIGN AND COMPONENT UNIT RESPONSIBILITY

Gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings of all types shall be furnished by the manufacturer of the pipe coupling and shall be designed as an integral system by the pipe-coupling manufacturer. Gaskets shall be designed for the coupling and appropriately sized to provide a watertight seal at the design pressure and temperature. Gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings shall be shipped with the pipe coupling and shall be clearly labeled indicating the origin of the material, including place and date of manufacture. Manufacturer's printed installation instructions shall be packaged with each pipe coupling.

2.02 TRANSITION COUPLINGS

Couplings for connecting different pipes having different outside diameters shall be steel: Dresser Style 62 or 162, Smith-Blair Series 413, Baker Series 212 or 220, or equal. Couplings shall have an internal full circumference ring pipe stop at the midpoint of the coupling. ID of coupling pipe stop shall equal ID of smaller diameter pipe.

2.03 FLANGED COUPLING ADAPTORS FOR DUCTILE IRON PIPE

- A. Adaptors for ductile iron pipe shall be steel.
- B. Flange ends of adaptors shall match the flange of the connecting pipe
- C. Minimum working pressure for the adaptor is 150 psi
- D. Adaptor shall be fully restrained to the pipe.
- E. Acceptable manufactures:
 - 1. Dresser Style 128
 - 2. Smith-Blair Type 911
 - 3. Or ENGINEER APPROVED EQUAL

2.04 BOLTS AND NUTS FOR FLANGES

See Section 15050: GENERAL PIPING REQUIREMENTS.

PART 3 - EXECUTION

3.01 INSTALLATION OF FLEXIBLE PIPE COUPLINGS AND SEGMENTED SLEEVE COUPLINGS

- A. Clean oil, scale, rust, and dirt from pipe ends. Clean gaskets in flexible pipe couplings before installing.
- B. Lubricate bolt threads per Specification Section 15050: GENERAL PIPING REQUIREMENTS prior to installation.
- C. Install threaded nut and bolt thread protection caps after completing the bolt, nut, and gasket installation. Install on buried and submerged flexible pipe couplings, transition couplings, flanged coupling adapters, dismantling joints, rubber molded expansion joints and segmented restrained sleeve couplings.

3.02 PAINTING AND COATING

- A. Coat flexible pipe couplings (including joint harness assemblies), transition couplings, segmented sleeve couplings, and flanged coupling adapters located indoors, in vaults and structures, and above ground with the same coating system as specified for the adjacent pipe. If the adjacent pipe is not coated, coat couplings per Specification Section 09901: PAINTING AND SPECIAL COATINGS - Service Condition A. Apply prime coat at factory.

3.03 HYDROSTATIC TESTING

Hydrostatically test flexible pipe couplings, expansion joints, segmented sleeve couplings, and expansion compensators in place with the pipe being tested.

PART 4 – PAYMENT

Payment for the work in this section shall not be paid for separately, but shall be included as part of the several unit prices and or lump sum amounts to which the work pertains to as stated in the Bid Proposal and no additional compensation will be made therefor.

END OF SECTION

SECTION 15125
WALL PENETRATIONS

PART 1 – GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of steel and cast-iron wall pipes and sleeves (including wall collars and seepage rings), and penetrations.

1.02 SUBMITTALS

- A. Submit shop drawings in accordance with Specification Section 01300: CONTRACTOR SUBMITTALS.
- B. Submit manufacturer's instructions for installing rubber annular hydrostatic sealing devices.

PART 2 – MATERIALS

2.01 GENERAL

Use fabricated steel wall sleeves with anchor collars when containing rubber annular hydrostatic sealing devices through which piping passes.

2.02 RUBBER ANNULAR HYDROSTATIC SEALING DEVICES

- A. Rubber annular hydrostatic sealing devices shall be of the modular mechanical type, utilizing interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe sleeve and the passing pipe. Assemble links to form a continuous rubber belt around the pipe, with a pressure plate under each bolthead and nut. The sealing device shall be Link-Seal Modular Seal Model No. LS-600 or equal.
- B. Materials of construction shall be as follows:

<u>COMPOUND</u>	<u>MATERIAL</u>
Wall Sleeve with Anchor Collar	Carbon Steel
Bolts & Nuts for links	Type 303 or 316 stainless steel
Sealing element	EPDM rubber

- C. The size of the wall sleeve needed to accommodate the passing pipe shall be as recommended by the rubber annular seal manufacturer.

SECTION 3 – EXECUTION

3.01 LOCATION OF PIPES AND SLEEVES

- A. Provide a wall or floor pipe sleeve where shown on the drawings and wherever piping passes through walls or floors in which the groundwater surface is above the pipe penetration.

3.02 INSTALLATION IN NEW CONCRETE WALLS AND SLABS

Install fabricated wall sleeves in walls before placing concrete. Do not allow any portion of the sleeve to touch any of the reinforcing steel. Install wall sleeve and collar assembly axially aligned with the piping to which it will be attached or will contain.

3.03 INSTALLATION OF RUBBER ANNULAR HYDROSTATIC SEALING DEVICES

Install in accordance with the manufacturer's instructions.

PART 4 – MEASUREMENT AND PAYMENT

Payment for the work in this section shall not be paid for separately, but shall be included as part of the unit prices or lump-sum bid amounts to which the work pertains to as stated in the Bid Proposal and no additional compensation/payment will be made.

END OF SECTION

SECTION 15140
PIPE SUPPORTS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Pipe supports.

1.02 RELATED WORK

- A. Section 09900: Painting

1.03 REFERENCES

1.04 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data: Provide manufacturers catalog data including load capacity.
- D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.05 REGULATORY REQUIREMENTS

- A. Conform with applicable code for support of plumbing, hydronic, steam, and steam condensate piping.

PART 2 - PRODUCTS

2.01 PIPE SUPPORTS

- A. Manufacturers:
 - 1. Standon, or ENGINEER approved equal.
- B. Supports and anchors shall be provided for all horizontal piping. Shop Drawings shall be provided, indicating locations and details of anchors.

- C. Contractor shall review all Drawings, including Structural Drawings, for details regarding pipe supports, anchors, hangers, and guides.
- D. All supports shall be of type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.
- E. Attachment:
 - 1. All supports shall be designed and installed to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, etc. All piping shall be installed with due regard to expansion and contraction and the type of hanger method of support, location of support, etc. shall be governed in part by this Specification.
- F. Finishes: Supports, shall be dipped in Zinc Chromate Primer before installation.
- G. Miscellaneous: Provide any other special foundations, hangers and supports indicated on the Drawings, specified elsewhere herein; or required by conditions at the site. Hangers and supporting structures for suspended equipment shall be provided as required to support the load from the building structure in a manner acceptable to the Architect/Engineer.

2.02 ACCESSORIES

- A. Drilled anchors in concrete or masonry shall be submitted for the approval by the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.02 PIPE SUPPORTS

- A. Support horizontal piping as scheduled.

PART 4 – MEASUREMENT AND PAYMENT

Payment for the work in this section shall not be paid for separately, but shall be included as part of the unit prices or lump-sum bid amounts to which the work pertains to as stated in the Bid Proposal and no additional compensation/payment will be made.

END OF SECTION

SECTION 15240
DUCTILE-IRON PIPE

PART 1 – GENERAL

1.01 DESCRIPTION

This section describes materials, testing, and installation of ductile-iron pipe and fittings 60 inches and smaller. This section shall be supplemental to SECTION C.2: APPROVED MATERIALS LIST of the SFCU Construcion Standards and Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. APWA Section 701: TRENCHING, EXCAVATION AND BACKFILL
- B. Specification Section 09961: FUSION BONDED EPOXY LININGS AND COATINGS
- C. Specification Section 09954: POLYETHYLENE SHEET ENCASEMENT (AWWA C105).
- D. Specification Section 15050: GENERAL PIPING REQUIREMENTS.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Supplemental Specification Section 01300: CONTRACTOR SUBMITTALS.
- B. Provide an affidavit of compliance with standards referenced in this specification, e.g., AWWA C151. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate that the minimum safety factor described in AWWA C153, Section 5.5, is met.
- C. Provide the following information:
 - 1. Mortar lining thickness.
 - 2. Wall thickness.
 - 3. Material test data for this project.
 - 4. Show deflections at push-on and mechanical joints.
 - 5. Submit joint and fitting details and manufacturer's data sheets.
- D. Submit copy of manufacturer's quality control check of pipe material and production. Include hydrostatic test records and acceptance test records. For each acceptance test, submit a stress-strain diagram showing yield strength, yield point, tensile strength, elongation, and reduction in area. Provide specimen test section

dimensions, speed, and method used to determine speed of testing, method used for rounding of test results, and reasons for replacement specimens, if any. Submit ring-bending test of pipe of the same diameter and pressure class as the pipe required for this project to prove ring-bending stress at 48 ksi results in a factor of safety of 2.0.

- E. Submit certificate that cement for mortar lining complies with ASTM C 150, designating type.
- F. Submit test report on physical properties of rubber compound used in the gaskets.
- G. Submit drawing or manufacturer's data sheet showing flange facing, including design of facing serrations.
- H. Submit weld procedure specification, procedure qualification record, and welder's qualifications prior to any welding to ductile-iron pipe.

PART 2 - MATERIALS

2.01 PIPE

- A. Pipe shall be cast ductile (nodular) iron, conforming to AWWA C151 and produced in the United States.
- B. Provide pipe in nominal 18- or 20-foot laying lengths.

2.02 PIPE MARKING

Plainly mark each length of straight pipe and each fitting at the bell end to identify the design pressure class, the ductile-iron wall thickness, and the date of manufacture, and the proper location of the pipe item by reference to the layout schedule. Mark the spigot end of restrained joint pipe to show clearly the required depth of insertion into the bell.

2.03 DESIGN CRITERIA

- A. Obtain the following information from the contract documents:
 - 1. Elevation of the top of pipe and of the completed ground.
 - 2. Alignment of the pipeline.
 - 3. Nominal internal diameter, ID.
 - 4. Joint types(s).

2.04 PIPE WALL THICKNESS

- A. Minimum wall thickness for pipe having push-on or mechanical joints, restrained joints, or plain ends shall be Pressure Class 150 as shown in the drawings.

- B. Minimum wall thickness for pipe having threaded flanges shall be Special Class 53 or Pressure Class 350.

2.05 FITTINGS

- A. Fittings shall conform to AWWA C153 with a minimum pressure rating of 250 psi. Material shall be ductile iron, Grade 70-50-05 as specified in ASTM A536. Flanges shall be flat faced.
- B. Mechanical joint ductile-iron fittings 18 through 48 inches conforming to AWWA C110 (except for laying length) with a minimum pressure rating of 250 psi may also be used.

2.06 FLANGES

- A. Flanges shall be solid back, 250-psi working pressure per AWWA C115. Flanges on pipe shall be either cast or threaded. Material shall be ductile iron. Flanges shall have bolt hole patterns in conformance to Class 125/150 ASTM B16.1.
- B. Flanged pipe and fittings shall be shop fabricated, not field fabricated. Threaded flanges shall comply with AWWA C115. Flanges shall be individually fitted and machine tightened in the shop, then machined flat and perpendicular to the pipe barrel. Flanges shall be backfaced parallel to the face of flange. Prior to assembly of the flange onto the pipe, apply a thread compound to the threads to provide a leak-free connection. There shall be zero leakage through the threads at a hydrostatic test pressure of 250 psi without the use of the gasket.
- C. Material for blind flanges shall be ductile iron.

2.07 PIPE LINING--CEMENT MORTAR

- A. Line pipe interior and fittings with cement-mortar per AWWA C104. Lining thickness shall be the double thickness listed in AWWA C104, Section 4.7. Lining material shall conform to ASTM C 150, Type II.
- B. Line blind flanges per Specification Section 09961: FUSION BONDED EPOXY LININGS AND COATINGS
- C. Lining shall be cured and seal coated per AWWA C104 Section 4.10 and 4.11.
- D. Loose areas of cement mortar lining are not acceptable. Remove and reconstruct lining in areas where quality is defective, such as sand pockets, voids over sanded areas, blisters, drummy areas, cracked areas, and thin spots. Longitudinal cracks in excess of 1/32 inch in width or where crack extends to metal shall be repaired with epoxy. Repair all cracks larger than 1/16 inch with epoxy.

2.08 GASKETS FOR FLANGES

See Specification Section 15050: GENERAL PIPING REQUIREMENTS.

2.09 GASKETS FOR MECHANICAL, PUSH-ON, AND RESTRAINED JOINTS

Synthetic rubber in accordance with AWWA C111.

2.10 BOLTS AND NUTS FOR FLANGES

See Specification Section 15050: GENERAL PIPING REQUIREMENTS.

2.11 JOINTS

- A. Joints in piping located in vaults and structures shall be flanged end as noted on the plans.
- B. Joints in buried piping shall be of the restrained, push-on or mechanical-joint type per AWWA C111 except where flanged joints are required to connect to valves, meters, and other equipment. Provide unrestrained buried joints except where restrained joints are specifically shown in the drawings.
- C. Restrained joints for piping 6 inches and larger shall be American Cast Iron Pipe "Lok-Ring" or "Flex-Ring," U.S. Pipe "TR-Flex," or equal. All weldments for restrained joints shall be tested by the liquid penetrant method per ASTM E 165. Restrained joints may also consist of mechanical joints with restraint system using follower ring and wedges.
- D. Restrained joints in 4-inch-diameter buried piping shall be American Cast Iron Pipe Company "Fast-Grip," U.S. Pipe Field-lok gasket within Tyton joint pipe and fittings, or equal. Joint restraint shall be certified to four times rated pressure of 200 psi by Factory Mutual.
- E. Provide thrust restraint as called for on the drawings.

2.12 MECHANICAL JOINT RESTRAINT SYSTEM USING FOLLOWER RING AND WEDGES

The restraining mechanism shall consist of a follower gland having a seal gasket and individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The system manufacturer shall provide all the components (follower ring, wedges, and gaskets) for the restraining device. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial. The joint restraint ring and its wedging components shall be constructed of ductile iron conforming to ASTM A 536, Grade 60-42-10. The wedges shall be ductile iron, heat-treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with mechanical joint bells conforming to AWWA C111 and AWWA

C153. The design shall use torque limiting twist-off nuts to provide actuation of the restraining wedges. The mechanical joint restraint shall be available in the size range of 3 through 48 inches. Minimum rated pressure shall be 350 psi for sizes 16 inches and smaller and 150 psi in sizes 18 inches and larger. Products: Megalug Series 1100 as manufactured by EBAA Iron, Inc., or equal.

2.13 DUCTILE-IRON PIPE WELDMENTS

- A. All welding to ductile-iron pipe, such as for bosses, joint restraint, and joint bond cables shall be done at the place of manufacture of the pipe. Perform welding by skilled welders who have experience in the method and materials to be used. Welders shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.
- B. Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Completely grind out porosity and cracks, trapped welding flux, and other defects in the welds in such a manner that will permit proper and complete repair by welding.
- C. Completed welds shall be inspected at the place of manufacture by the liquid penetrant method. Conform to the requirements specified in ASTM E 165, Method A, Type I or Type II. The materials used shall be water washable and nonflammable.

PART 3 - EXECUTION

3.01 DELIVERY, UNLOADING, AND TEMPORARY STORAGE OF PIPE AT SITE

- A. Both ends of pipe shall be covered during delivery from factory to the job site.
- B. Limit onsite pipe storage to a maximum of thirty days.
- C. Use unloading and installation procedures that avoid cracking of the lining. If necessary, use plastic sheet bulkheads to close pipe ends and keep cement-mortar lining moist.
- D. Deliver the pipe alongside the pipe laying access road over which the pipe trailer-tractors can travel under their own power. Place the pipe in the order in which it is to be installed and secure it from rolling.
- E. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel. Field repair linings damaged by unloading or installation procedures.

3.02 SANITATION OF PIPE INTERIOR

- A. During laying operations, **THE INTERIOR OF THE PIPE MUST REMAIN CLEAN AND FREE FROM ANY MATERIALS.** Do not place tools, clothing, or other materials in the pipe.

- B. When pipe laying is not in progress, close the ends of the installed pipe by a child- and vermin-proof plug such as the Foreman Night Cap by Advanced Products and System or equal.

3.03 **INSTALLING FLANGED PIPE AND FITTINGS**

Install in accordance with Specification Section 15050: General Piping Requirements. Cut the bore of the gaskets such that the gaskets do not protrude into the pipe when the flange bolts are tightened.

3.04 **INSTALLING GROOVED-END PIPE AND FITTINGS**

See Specification Section 15050: GENERAL PIPING REQUIREMENTS.

3.05 **INSTALLING BURIED PIPING**

- A. Install in accordance with APWA Specification Section 701: TRENCHING, EXCAVATION AND BACKFILL and as follows.
- B. When installing piping in trenches, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert.
- C. Assemble restrained joints per manufacturer's instructions.

3.06 **JOINT DEFLECTIONS FOR BURIED PIPE**

- A. Joint deflections shall be per AWWA C6001, Section 4.3.4.4.

Pipe Size (inches)	Maximum Deflection per Joint (degrees)	
	Push-On Joint	Mechanical Joint
12	4	4

- B. Small angular changes (less than 7 degrees) in horizontal alignment defined in the drawings by a point of inflection (PI) with no accompanying curve data shall be approximated as a curve by deflecting by equal amounts equal length pipe segments to create a curve equally distributed on both sides of the given PI. Accomplish a larger (greater than or equal to 7 degrees) change in horizontal alignment where a curve is not called for in the drawings through the use of an elbow placed at the station of the PI shown in the drawings. Provide thrust restraint as required in the drawings.
- C. Small angular changes (less than 5 degrees) in vertical alignment may be accomplished by the use of pulled joints. For larger vertical deflections, place an elbow at the station and elevation of the vertical PI shown in the drawings. Provide thrust restraint as required in the drawings.

- D. Assemble joints in accordance with AWWA C600 and the manufacturer's recommendations.

3.07 INSTALLING ABOVEGROUND OR EXPOSED PIPING

See Specification Section 15050: GENERAL PIPING REQUIREMENTS.

3.08 PAINTING AND COATING

- A. Provide asphaltic coating on buried pipe per AWWA C151.

3.09 POLYETHYLENE ENCASEMENT OF BURIED PIPE AND FITTINGS

Wrap buried pipe, fittings, grooved-end couplings, and joints with polyethylene per Specification Section 09954: POLYETHYLENE SHEET ENCASEMENT (AWWA C105).

3.10 CLEANING PIPE

Sweep pipe clean of all dirt and debris. If hardened mud exists in the pipe, remove with the use of pressurized water hoses.

3.11 HYDROSTATIC TESTING

Test in accordance with APWA Specification Section 801 INSTALLATION OF WATER TRANSMISSION, COLLECTOR, AND DISTRIBUTION LINES.

PART 4 – MEASUREMENT AND PAYMENT

Costs for the work in this Section shall not be paid for separately, but shall be considered incidental to the installation of the pipe. This bid item shall include all costs associated with the labor and material for the installation of the waterline including fittings, restrained or unrestrained joints, etc.

END OF SECTION

SECTION 16010

GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section includes general administrative and procedural requirements of electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
 - 1. Submittals
 - 2. Coordination Drawings
 - 3. Record Documents
 - 4. Maintenance Manuals
 - 5. Rough-Ins
 - 6. Electrical Installations
 - 7. Cutting and Patching

1.02 RELATED WORK

- A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions, and Division 1 Specification Sections apply to all Sections of Division 16.
- B. The requirements listed under General Conditions and Supplementary Conditions and the General Requirements are applicable to this section and all subsequent sections of Division 16 and form a part of the contract.
- C. Section 02221: Trenching, Backfilling and Compacting.
- D. See Division 1, Coordination for additional requirements.
- E. See Division 1, Cutting and Patching for additional requirements.
- F. Section 01340: Shop Drawings, Product Data and Samples.
- G. Section 09901: Painting and Special Coatings.

1.03 CODES AND PERMITS

- A. Perform electrical work in strict accordance with the applicable provisions of the National Electrical Code, Latest Edition; National Electric Safety Code, Latest Edition; the Uniform Building Code, Latest Edition as adopted and interpreted by the State of New Mexico, and the National Fire Protection Association (NFPA Regulations), current adopted edition. Provide all materials and labor necessary to comply with rules, regulations and ordinances. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern. The Contractor shall hold and save the Engineer free and harmless from liability of any nature or kind arising from his failure to comply with codes and ordinances.
- B. Secure and pay for all permits necessary for performance of the work. Pay for all utility connections unless otherwise specified herein.
- C. The following lists applicable codes and standards that, as a minimum, shall be followed.
 - 1. Applicable county and state electrical codes, laws and ordinances.
 - 2. National Electrical Manufacturer's Association Standards.
 - 3. National Electrical Code.
 - 4. National Electrical Safety Code.
 - 5. Underwriters Laboratories, Inc. Standards.
 - 6. American National Standards Institute.
 - 7. American Society for Testing Materials Standards.
 - 8. Standards and requirements of local utility companies.
 - 9. National Fire Protection Association Standards.
 - 10. Institute of Electrical and Electronics Engineers Standards
 - 11. Insulated Cable Engineers Association
 - 12. Occupational Safety and Health Act.
 - 13. Uniform Fire Code.
 - 14. Americans with Disabilities Act
 - 15. Commercial and Industrial Insulation Standards (MICA).

1.04 RECORD DRAWINGS

- A. See Division 1, for requirements associated with Project Record Drawings.
- B. Maintain a complete and accurate set of marked up blue-line prints showing information on the installed location and arrangement of all electrical work, and in particular, where changes were made during construction. Keep record drawings accurate and up-to-date throughout the construction period. Record drawings may be reviewed and checked by the Engineer during the construction and in conjunction with review and approval of monthly pay requests. Include copies of all addenda, RFI's, bulletins, and change orders neatly taped or attached

to record drawing set. Transmit drawings to the Engineer at the conclusion of the project for delivery to the Owner's Representative.

- C. Prepare record documents in accordance with the requirements in Division 1, Section 01700: Contract Closeout. In addition to the requirements specified in Division 1, indicate installed conditions for:
 - 1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
 - 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.05 QUALIFICATIONS

- A. All electricians shall be skilled in their respective trade.

1.06 SUBSTITUTIONS

- A. Identification of Division 16 equipment, fixtures, and materials listed within this Specification and in the Equipment Schedules on the drawings, which are identified by manufacturer's name, trade name, and/or model numbers are generally not meant to give preference to any manufacturer, but are provided to establish the design requirements and standards. Additional manufacturers judged to be "equivalent" to the specified product may also be listed.
- B. Equipment submitted for substitution must fit the space conditions leaving adequate room for maintenance around all equipment. A minimum of 36 inches, or more if required by Code, must be maintained clear in front of all electrical panels, starters, gutters, or other electrical apparatus. Submit drawings showing the layout, size and exact method of interconnection of conduit, wiring and controls, which shall conform to the manufacturer's recommendations and these specifications. The scale of these drawings shall be scale of Contract Drawings. The Contractor shall bear the excess costs, by any and all crafts, of fitting the equipment into the space and the system designated. Where additional labor or material is required to permit equipment submitted for substitution to function in an approved manner, this shall be furnished and installed by the Contractor without additional cost to the Owner.

- C. Equipment submitted for substitution shall be approved in writing by the Owner or his representative and shall be accompanied by the following:
 - 1. A sample of each item submitted for substitution shall accompany the submittal.
 - 2. Provide a unit price quotation with each item intended for substitution. Include a unit price for the specified item and a unit price for the intended substitute item. Provide a total (per item) of the differential payback to the Owner should the intended substitute item be equivalent to that which is specified.
- D. Substitutions shall be approved in writing by the Owner or his representatives. The determination of the Owner shall be final.

1.07 PRIOR APPROVAL

- A. Requests for prior approval received after the specified due date may not be considered.
- B. Division 16 prior approval equipment, fixtures, and materials which are submitted as specified herein and accepted will be included in an Addendum. Equipment, fixtures and materials which are accepted under this prior approval process are accepted for bidding purposes only, subject to all requirements, terms, and conditions of the Contract Documents.

1.08 DEFINITIONS

- A. Definitions of terms will be found in the National Electric Code, Electrical Safety Orders.
- B. Whenever a term is used in this Specification which is defined in the Code, the definition given will govern its meaning in this Specification.
- C. Whenever a technical term is used which does not appear in the Code, the definition to govern its meaning in these Specifications will be found in the Standard Dictionary of Electrical and Electronic Terms, published by the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, New Jersey 08855-1331.
- D. "Provide" means furnish, install, connect and test unless otherwise noted.
- E. Wet Interior Locations: Underground or below grade structure locations subject to submergence or which contain water/liquid piping with the possibility for submergence.

- F. Dry Interior Locations: All interior locations not defined as “Wet Interior Locations.”
- G. Damp Exterior Locations: All locations beneath a protective roof structure preventing direct rain exposure, but does not have protective walls preventing indirect exposure.
- H. Wet Exterior Locations: All locations exterior to buildings not under a protective roof structure and directly exposed to rain.
- I. Corrosive Locations: Locations defined by Engineer to have a corrosive atmosphere due to gases or liquids.
- J. Hazardous Locations: Areas considered to be classified as Class 1, Division 1 or 2 as defined in the NEC (NFPA 70, most current edition).
- K. Voltage Classes: System voltages referenced as “Low Voltage”, “Medium Voltage” and “High Voltage” shall be defined as identified in ANSI C84.1-2011.3 “System voltage classes”.

1.09 SUBMITTALS

- A. The Contractor shall submit to the Engineer submittal brochures of equipment, fixtures and materials to be furnished under Division 16 as indicated in Section 01340.
- B. Unauthorized Substitutions: If substitute materials, equipment or systems are installed without prior review or are installed in a manner which is not in conformance with the requirement of this Specification and for which the Contractor has not received a written review, removal of the unauthorized materials and installation of those indicated or specified shall be provided at no change in contract amount.
- C. Install equipment in accordance with the manufacturer's recommendations. Provide accessories and components for optimum operation as recommended by the manufacturer.
- D. Costs for the preparation, correction, delivery, and return of the submittals shall be borne by the Contractor.
- E. Complete data must be furnished showing performance, quality and dimensions. No equipment or materials shall be purchased prior to receiving written notification from the Engineer that submittals have been reviewed and marked either "NO EXCEPTIONS TAKEN" or "EXCEPTIONS AS NOTED". Submittals returned marked "EXCEPTIONS AS NOTED" do not require resubmittal

provided that the Contractor agrees to comply with all exceptions noted in the submittal, and so states in a letter to the Engineer.

- F. Review of Submittals: Submittals will be reviewed with reasonable promptness, but only for conformance with the design concept of the Project and for conformance with the information indicated on the Drawings and stated in the Specifications. Review of a separate item as such will not indicate review of the assembly in which the item functions. Review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents, nor for errors or omissions in the submittals; or for the accuracy of dimensions and quantities, the adequacy of connections, and the proper and acceptable fitting, execution, functioning and completion of the work. Review shall not relieve the Contractor of responsibility for the equipment fitting within the allotted space shown on the drawings with all clearances required for equipment operation, service and maintenance including a minimum of 3 feet clear in front of all electrical equipment and panels as defined by the National Electric Code. Any relocation of mechanical and/or electrical equipment, materials and systems required to comply with minimum clearances shall be provided by the Contractor without additional cost under the Contract.
- G. Shop Drawings: Unless the following information is included, shop drawings will be returned unchecked:
1. Cover sheet for each submittal, listing equipment, products, and materials, and referencing data and sections in Specifications and drawings. Clearly reference project name and provide space for a review stamp.
 2. Cover sheet shall clearly identify deviations from specifications, and justification.
 3. Include all related equipment in a single submittal to allow complete review. Similar equipment may be submitted under a common cover sheet.
 4. Size, dimensions, and weight of equipment.
 5. Equipment performance under specified conditions, not a copy of scheduled data on drawings.
 6. Indicate actual equipment proposed, where data sheets indicate more than one (1) device or equipment.
- H. Use of substitutions reviewed and checked by the Engineer does not relieve the Contractor from compliance with the Contract Documents. Contractor shall bear all extra expense resulting from the use of any substitutions where substitutions affect adjoining or related work required in this Division or other Divisions of this Specification.
- I. If Contractor substitutes equipment for that drawn to scale on the drawings, he shall prepare a 1/4" = 1'-0" installation drawing for each equipment room where a substitution is made, using dimensions of substituted equipment, and including piping, and electrical equipment requirements, to verify that equipment will fit

space with adequate clearances for maintenance. This 1/4" = 1'-0" fabrication drawing shall be submitted, for review by the Engineer, with the shop drawing submittals of the substituted. Failure to comply with this requirement will result in the shop drawings being returned unchecked.

1.10 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1, Section 01700 Contract Closeout. In addition to the requirements specified in Division 1, include the following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Servicing instructions and lubrication charts and schedules.

1.11 DRAWINGS AND SPECIFICATIONS

- A. Electrical drawings are diagrammatic, but shall be followed as closely as actual construction and work of the other sections shall permit. Size and location of equipment is drawn to scale wherever possible. Do not scale from electrical drawings.
- B. Drawings and specifications are for the assistance and guidance of the Contractor. Exact locations, distances, and levels will be governed by the building. The Contractor shall make use of data in all the Contract Documents to verify information at the building site.
- C. In any case where there appears to be a conflict between that which is shown on the electrical drawings, and that shown in any other part of the Contract Documents, the Contractor shall notify and secure directions from the Engineer.
- D. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or the specifications, request clarification. Do not proceed with work without direction.
- E. The Engineer shall interpret the drawings and the specifications. The Engineer's interpretation as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished thereunder shall be accepted as final and conclusive.
- F. Where items are specified in the singular, this division shall provide the quantity as shown on drawings plus any spares or extras indicated on the drawings or in the specifications.

- G. Investigate structural and finish conditions and arrange work accordingly. Provide all fittings, equipment, and accessories required for actual conditions.

1.12 SIMILAR MATERIALS

- A. All items of a similar type shall be products of the same manufacturer.
- B. Contractor shall coordinate among suppliers of various equipment to assure that similar equipment type is product of the same manufacturer.
- C. Examples of similar equipment types include but are not limited to:
 - 1. Power Circuit Breakers
 - 2. Enclosed Case Circuit Breakers
 - 3. Batteries
 - 4. UPS
 - 5. Surge Protection Devices
 - 6. Motor Starters
 - 7. Transformers
 - 8. Panelboards
 - 9. Switchboards
 - 10. Disconnects
 - 11. Fuses
 - 12. Transfer Switches

1.13 PRODUCT STORAGE, HANDLING AND DELIVERY

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.14 WARRANTY

- A. Following guarantee is a part of the specifications and shall be binding on the Contractor:
 - 1. "The Contractor guarantees that this installation is free from ALL defects. He agrees to replace or repair to the satisfaction of the Owner's Representative any part of the installation which may fall within a period of one year after date established below, provided that such failure is due to defects in the materials or workmanship or to failure to follow the specifications and drawings. Warranty of the Contractor-furnished equipment or systems shall begin on the date the system or equipment is placed in operation for beneficial use of the Owner or occupancy by the Owner, whichever occurs first; such date to be determined in writing by

the Owner's Representative by means of issuing a 'Certificate of Substantial Completion'."

- B. The extent of guarantees or warranties by Equipment and/or Materials Manufacturers shall not diminish the requirements of the Contractor's guarantee-warranty to the Owner.
- C. All items of electrical equipment furnished and installed under Division 16 shall be provided with a full two (2) year parts and labor warranty unless extended by other divisions of this specification.

PART 2 PRODUCTS

2.01 QUALITY OF MATERIALS

- A. All equipment and materials shall be new, and shall be the standard product of manufacturers regularly engaged in the production of electrical equipment, and shall be the manufacturer's latest design. Specific equipment, shown in schedules on drawings and specified herein, is to set forth a standard of quality and operation.

2.02 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 those indicated on the electrical drawings, make all adjustments to wire and conduit size, controls, over current protection and installation as required to accommodate the equipment supplied. Delineate all adjustments to the drawings reflecting the electrical system in a submittal to the Contract Administrator immediately upon knowledge of the required adjustment.

PART 3 EXECUTION

3.01 COOPERATION WITH OTHER TRADES

- A. Coordinate all work so that the construction operations can proceed without harm to the Owner from interference, delay, or absence of coordination. The Contractor shall be responsible for the size and accuracy of all openings.

3.02 DRAWINGS

- A. The electrical drawings show the general arrangement of all lighting, power, special systems, equipment, etc., and shall be followed as closely as actual building construction and work of other trades will permit. Whenever discrepancies occur between plans and specifications, the most stringent shall govern. All Contract Documents shall be considered as part of the work. Coordinate with architectural, mechanical, and structural drawings. Because of the small scale of the electrical drawings, it is not possible to indicate all offsets, fittings and accessories, which may be required. Provide all fittings, boxes, and accessories as may be required to meet actual conditions. Should conditions necessitate a rearrangement of equipment, such departures and the reasons therefor, shall be submitted by the Contractor to the Engineer for review in the form of detailed drawings showing the proposed changes. No changes shall be made without the prior written approval of the Engineer. All changes shall be marked on record drawings.
- B. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, the question shall be submitted to the Engineer, whose decision shall be final and conclusive.
- C. Installation of all equipment shall be arranged to provide all clearances required for equipment operation, service, and maintenance, including minimum clearance, as defined by the National Electric Code (NEC).
- D. The installation of all concealed electrical systems shall be carefully arranged to fit within the available space without interference with adjacent structural and mechanical systems.

3.03 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical system, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with all other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in all other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.
5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum clearance possible.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Install access panel or doors where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems requiring installation at a specified slope.

B. Install items level, plumb and parallel, and perpendicular to the building.

3.04 FIELD MEASUREMENTS

- A. No extra compensation shall be claimed or allowed due to differences between actual dimensions, including dimensions of equipment, fixtures and materials furnished, and those indicated on the drawings. Contractor shall examine adjoining work, and shall submit to Engineer any work which must be corrected. Review of submittal data in accordance with paragraph "Submittals" shall in no manner relieve the Contractor of responsibility for the proper installation of the electrical work within the available space. Installation of equipment and systems

within the building space shall be carefully coordinated by the Contractor.

3.05 EQUIPMENT SUPPORT

- A. Provide support for equipment to the building structure. Provide all necessary structures, inserts, sleeves, firestops and hanging devices for installation of equipment. Coordinate installation of devices. Verify with the Engineer that the devices and supports are adequate as intended and do not overload the building's structural components in any way.

3.06 PAINTING

- A. All finish painting of electrical systems and equipment will be under "Painting", unless equipment is hereinafter specified to be painted.
- B. All equipment shall be provided with factory applied standard finish, unless otherwise specified.
- C. Touch-Up: If the factory finish on any equipment is damaged in shipment or during construction of the building, the equipment shall be refinished to the satisfaction of the Engineer.

3.07 PROTECTION OF MATERIALS AND EQUIPMENT

- A. The Contractor shall be responsible for the protection of all work, materials and equipment furnished and installed under this section of the specifications, whether incorporated in the building or not.
- B. All items of electrical equipment shall be stored in a protected weatherproof enclosure prior to installation within the building, or shall be otherwise protected from the weather in a suitable manner approved by the Engineer.
- C. The Contractor shall provide protection for all work and shall be responsible for all damage done to property, equipment and materials. Storage of materials within the building shall be approved by the Engineer prior to such storage.
- D. Conduit openings shall be closed with caps or plugs, or covered to prevent lodgment of dirt or trash during the course of installation. At the completion of the work, fixtures, equipment and materials shall be cleaned and polished thoroughly and delivered in a condition satisfactory to the Engineer.

3.08 EXCAVATION

- A. Provide all excavation, trenching and backfilling required.
- B. Slope sides of excavations to comply with codes and ordinances. Shore and brace as required for stability of excavation.

3.09 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code".

3.10 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.11 APPLICATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturer's printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
 - 2. Comply with recommendations of ASTM C 790 for use of acrylic-emulsion joint sealants.
- B. Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- C. Firestopping Sealant: Provide sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors

and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.12 INSTALLATION OF ACCESS DOORS

- A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- B. Adjust hardware and panels after installation for proper operation.

3.13 CUTTING AND PATCHING

- A. Perform cutting and patching per requirements below:
 - 1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-time Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Upon written instructions from the Contracting Officer, uncover and restore Work to provide for Contracting Officer observation of concealed Work.
 - 2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
 - 3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
 - 4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 5. During cutting and patching operations, protect adjacent installations.
 - 6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced installers.

3.14 MANUFACTURER'S INSTRUCTIONS

- A. All equipment shall be installed in strict accordance with recommendations of the manufacturer. If such recommendations conflict with plans and specifications, the Contractor shall submit such conflicts to the Engineer who shall make such compromises as he deems necessary and desirable.

3.15 CONCRETE BASES AND HOUSEKEEPING PADS

- A. Install concrete bases and housekeeping pads under all freestanding electrical equipment unless otherwise noted.
- B. Contractor shall be responsible for the accurate dimensions of all pads and bases and shall furnish and install all anchor bolts, etc. Coordinate weight of concrete bases and housekeeping pads with the structural engineer.
- C. All concrete bases and housekeeping pads shall conform to the requirements specified under Division 3, Concrete, portions of these specifications. Pad foundations shall be 4" high minimum, unless otherwise indicated on the drawings. Chamfer edges shall be 1". Faces shall be free of voids and rubbed smooth with Carborundum block after stripping forms. Tops shall be level. Provide dowel rods or other required material in floor for lateral stability and anchorage.
- D. Equipment anchor bolts shall be set in a galvanized pipe or sheet metal sleeves 1" larger than bolt diameter. Anchor bolts shall be high strength steel J shape. Anchor bolt design shall be arranged and paid for by the Contractor.

3.16 TESTS

- A. All tests shall be conducted in the presence of the designated and authorized Owner's Representative. The Contractor shall notify the Engineer one week in advance of all tests. The Contractor shall furnish all necessary equipment, materials, and labor to perform the required tests.

3.17 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. The Contractor shall furnish the Engineer complete operating and maintenance instructions covering all units of electrical equipment herein specified together with parts lists. Furnish four (4) copies of all the literature; each shall be suitably bound in loose-leaf book form.
- B. Operating and maintenance manuals as required herein shall be submitted to the

Engineer for review not less than two (2) weeks prior to the date scheduled for the Contractor to provide Operating and Maintenance Instructions to the Owner as specified herein.

- C. Upon completion of all work and all tests, Contractor shall furnish the necessary skilled labor and helpers for operating the electrical systems and equipment for a period of five (5) days of eight (8) hours each. During this period, the Contractor shall instruct the Owner or his representative in the operations, adjustment and maintenance of all equipment furnished. Contractor shall provide at least two weeks notice to the Engineer in advance of this period, with a written schedule of each training session, the subject of the session, the Contractors' representatives who plan to attend the session, and the time for each session.

3.18 CERTIFICATIONS

- A. Before receiving final payment, certify in writing that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these specifications. Submit certifications and acceptance certificates to the Contracting Officer, including proof of delivery of O&M manuals, spare parts required, and equipment warranties, which shall be bound with O&M manuals.

3.19 INTERRUPTING SERVICES

- A. The Contractor shall coordinate the installation of all work within the facility in order to minimize interference with the operation of existing electrical telephone, fire alarm, and utility systems during construction. Connections to existing systems requiring the interruption of service within the facility shall be carefully coordinated with the Owner to minimize system downtimes. Requests for the interruption of existing services shall be submitted to the Engineer in writing a minimum of two (2) weeks before the scheduled date. Absolutely no interruption of the existing services will be permitted without the written review of the Engineer.

3.20 OPERATION PRIOR TO ACCEPTANCE

- A. Operation of equipment and systems installed by the Contractor for the benefit of the Owner prior to substantial completion will be allowed providing a written agreement between the Owner and the Contractor has established warranty and other responsibilities to the satisfaction of both parties.

3.21 SITE VISITS AND OBSERVATION OF CONSTRUCTION

- A. The Engineer will make periodic visits to the project site at various stages of construction in order to observe the progress and quality of various aspects of the Contractor's work, in order to determine in general if such work is proceeding in accordance with the Contract Documents. This observation by the Engineer, however, shall in no way release the Contractor from his complete responsibility to supervise, direct, and control all construction work and activities, nor shall the Engineer have authority over, or a responsibility to means, methods, techniques, sequences, or procedures of construction provided by the Contractor or for safety precautions and programs, or for failure by the Contractor to comply with all law, regulations, and codes.

3.22 MEASUREMENT AND PAYMENT

- A. Work covered under this section of the specifications, and costs associated therewith, shall be included in the contract price for the item to which the work applies. No separate payment shall be made.

END OF SECTION

SECTION 16111

CONDUIT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Conduit, conduit couplings, connections, adapters, fittings, clamps, hangers and appurtenant hardware.

1.02 RELATED WORK

- A. Specification Section 16010: Basic Electrical Requirements.
- B. Specification Section 16123: Low-Voltage Wire and Cable.
- C. Specification Section 16130: Boxes.

1.03 REFERENCES

- A. ANSI C80.1 - Rigid steel conduit, zinc-coated.
- B. ANSI C80.3 - Electrical Metallic Tubing - zinc coated.
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. FS WW-C-566 - Specification for flexible metal conduit.
- F. NECA "Standard of Installation".
- G. NEMA RN 1 - Polyvinyl Chloride (PVC) externally-coated galvanized rigid steel conduit and electrical metallic tubing.
- H. NEMA TC 2 - Electrical plastic tubing (EPT) and conduit (EPC-40 and EPC-80).
- I. NEMA TC 3 - PVC fittings for use with rigid PVC conduit and tubing.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.05 DEFINITIONS

- A. See Section 16010 for description of Wet Interior Locations, Dry Interior Locations, and Exterior Locations.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm experienced in manufacturing underground precast concrete utility structures of types and sizes required and similar to those indicated for this Project. Firm must have a record of successful in-service performance.
- B. Comply with NFPA 70 "National Electrical Code" and ANSI C2 "National Electrical Safety Code" for components and installation.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver conduits to site with ends capped. Store nonmetallic conduits with supports to prevent warping, and deforming, and cover to protect from UV degradation.
- B. All conduits with visible damage, corrosion or discoloration from UV exposure will be rejected.

PART 2 PRODUCTS

2.01 GENERAL

- A. Application: See conduit schedule in PART 3 for the application of the following types of conduits to this Project. It should be noted that not all conduit types specified in PART 2 of this Specification will necessarily be used on this Project.

2.02 ELECTRICAL METALLIC TUBING (EMT)

- A. Type: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB1; compression type, steel or malleable steel.
- C. Grounding Bushings: ANSI/NEMA FB1; insulated lay-in grounding type, steel or malleable steel.
- D. Listing: UL 797 listed.

2.03 RIGID METALLIC CONDUIT (RMC)

- A. Conduit: ANSI C80.1; Rigid Galvanized Steel Conduit.
- B. Conduit: ANSI C80.5; Rigid Aluminum Conduit.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; threaded type, steel or malleable iron. Compression, setscrew, and crimp type fittings and conduit bodies are not acceptable.
- D. Grounding Bushings: ANSI/NEMA FB 1; insulated lay-in grounding type, steel or malleable iron.
- E. Listing: UL 6 listed.

2.04 POLYVINYL-CHLORIDE COATED RIGID METAL CONDUIT (PVC-RMC)

- A. The PVC coated galvanized rigid steel conduit must be UL Listed. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be UL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed. All conduit

and fittings must be new, unused material. Applicable UL standards may include: UL 6 Standard for Safety, Rigid Metal Conduit, UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.

- B. The PVC coated galvanized rigid conduit must be ETL Verified to the Intertek ETL SEMKO High Temperature H2O PVC Coating Adhesion Test Procedure for 200 hours. The PVC coated galvanized rigid conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard.
- C. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.
- D. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.
- E. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
- F. Form 8 Condulets, 1/2" through 2" diameters, shall have a tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be available.
- G. Form 8 Condulets shall be supplied with plastic encapsulated stainless steel cover screws.
- H. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.
- I. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).
- J. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.
- K. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.
- L. Independent certified test results shall be available to confirm coating adhesion under the following conditions

1. Conduit and conduit exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
 2. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
 3. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
 4. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.
- M. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts will be supplied with plastic encapsulated nuts that cover the exposed portions of the threads.
- N. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit.
- O. Manufacturer / Product:
1. Plasti-Bond Red.
 2. or equal.

2.05 RIGID NONMETALLIC CONDUIT (RNMC)

- A. RNMC of polyvinyl chloride:
1. Per NEC 347, UL 651 and NEMA TC2 for EPC-40.
 2. UL-listed for use with 90 degree Celsius conductors.
 3. Ultraviolet resistant, Schedule 40 polyvinyl chloride (except Schedule 80 where called for on Drawings).
 4. Joints: glued, except provide bell-and-spigot expansion joint with "O" rings where required for expansion/contraction.
 5. Fittings and cement: by conduit manufacturer.
 6. Manufacturer / Product:
 - a. Carlon Plus 40/Plus 80.
 - b. or equal.
- B. RNMC of Fiberglass-Reinforced Epoxy:
1. Per NEMA TC-14 2002 and ASTM D-2105.
 2. UL-listed for use with 90 degree Celsius conductors.
 3. Ultraviolet-resistant, fiberglass-reinforced epoxy.
 4. Minimum trade size allowed: 2".
 5. Wall thickness:

- a. 0.066 for 2" through 3½" conduit.
- b. 0.096 for 4" through 6" conduit.
- 6. Joints: bell-and-spigot with triple seal method; provide expansion joint where required for expansion/contraction.
- 7. Fittings: by conduit manufacturer.
- 8. Product:
 - a. United Fiberglass.
 - b. or equal.

2.06 FLEXIBLE METAL CONDUIT (FMC)

- A. Conduit: FS WW-C-556, flexible steel conduit.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, steel or malleable iron.
- C. Listing: UL listed.

2.07 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

- A. Per NEC 351 and UL 360.
- B. Aluminum with a sheath rated for use with 90 degree Celsius conductors.

2.08 FLEXIBLE EXPLOSION-PROOF CONDUIT (XPFC)

- A. Braided steel or copper alloy with inner insulating sleeve.
- B. Fittings: threaded.
- C. Product:
 - 1. Crouse-Hinds Series EC.
 - 2. or equal.

2.09 COUPLINGS

- A. ENMT: glued on fitting same as used for coupling RNMC.

- B. EMT:
 - 1. Steel, not die-cast.
 - 2. Concrete-tight and rain-tight compression type.
 - 3. Set screw or indenter type will not be acceptable.
- C. LFMC, FMC: not allowed.
- D. Other conduits: as required by NEC and recommended by manufacturer.

2.10 CONNECTORS

- A. ENMT:
 - 1. Female glue to male thread type.
 - 2. Held to box with a locknut, not snap-on.
- B. EMT:
 - 1. Steel, not die-cast.
 - 2. Concrete-tight and rain-tight compression type.
 - 3. Set screw or indenter type will not be acceptable.
- C. FMC:
 - 1. Steel squeeze type.
 - 2. Appleton 7484.
 - 3. or equal.
- D. LFMC: liquid-tight steel, insulated throat.
 - 1. Steel squeeze type.
 - 2. Appleton ST/STB.
 - 3. or equal.
- E. By Box Type:
 - 1. NEMA 4, NEMA 4X stainless steel, or NEMA 13: watertight hub or threaded inlet on box.
 - 2. NEMA 12: "O-ring" type connector.
 - 3. NEMA 7 or cast boxes: threaded inlet on box.
 - 4. NEMA 1 or galvanized steel: as in 2.15A - D or insulated throat steel for other conduits.

PART 3 EXECUTION

3.01 DRAWINGS

- A. Conduit Runs:
1. Conduit runs are not fully detailed on the Drawings and do not necessarily call out all specific junction boxes, fittings, or connection types that may be required.
 2. Conduits are shown in spatial schematic location only relative to other structures. Contractor shall evaluate final route as necessary for final installation in compliance with NEC requirements and as approved by Engineer prior to installation.
 3. In addition to conduits shown:
 - a. Install as implied by circuiting, and as required for a complete system.
 - b. Install as called for on the One-Line Diagram.

3.02 INSTALLATION - GENERAL

- A. Install conduit in accordance with NECA "Standard of Installation".
- B. Where indicated on the Drawings, and where necessary to terminate conductors, tap-off, or redirect multiple conduit runs, provide appropriately designed junction boxes. Provide pullboxes to limit the number of directional changes of conduit to a total of not more than 270 cumulative degrees in any run between pull-boxes. Conduit runs between pull-boxes shall be limited to 400 feet maximum, less 100 feet for each 90-degree change in direction. Provide pull boxes, if necessary to meet these requirements, in accordance with Specification Section 16130: Boxes.
- C. Maintain minimum 6 inch clearance between conduit and piping for above grade installations, 12 inches clearance for below grade installations, unless otherwise noted.
- D. Maintain minimum 12 inch clearance between conduit and surfaces with temperature exceeding 104 degrees F (40 degrees C).
- E. Support conduit at a maximum of 4 feet on center and within one foot of elbow, bend, change of direction, and terminations.
- F. Use grounding bushings on conduit terminations.

- G. Use conduit hubs to fasten conduit to sheet metal enclosures. Conduit connections shall maintain the integrity of the NEMA rating of the enclosure they enter.
- H. Provide pull wire/rope per Specification Section 16123: Low-Voltage Wire and Cable in each empty conduit.
- I. Join nonmetallic conduit (PVC) using cement recommended by conduit manufacturer.
- J. Conduit bends in all but EMT:
 - 1. Factory-made or made with a conduit bending machine recommended by the conduit manufacturer. Handmade bends will not be acceptable.
 - 2. All bends shall be made with a bender that is not capable of reducing the size of the conduit while being bent, and shall leave no marks or scars on conduit.
 - 3. Where a conduit bank changes plane while changing direction it is acceptable to use factory 90-degree elbows for the largest conduit in the bank. All conduits smaller than the largest conduit shall use the same radius as the largest conduit.
 - 4. Where a conduit bank stays in the same plane and changes direction, all conduits shall have the same radius center point/concentric bends (exception: where the bank of conduits is less than five the conduits can have the same radius provided there are no concentric bends in the area).
 - 5. Where a conduit bank offsets from one plane to another plane all bends shall match in bend angle, distance between bends and placement of bends.
 - 6. Where a conduit bank offsets on the same plane, the center of the bend shall line up on all adjacent bends while the distance between conduits is maintained the same throughout.
- K. Make bends in EMT or in 1/2" and 3/4" IMC with a hand bender that fully supports the side walls.
- L. Conduit Routing:
 - 1. All conduit shall be concealed in finished areas and where indicated on the Drawings.
 - 2. In many places, such as at motors and surface-mounted wiring devices in process rooms and electrical rooms, the end of a run may be an exposed vertical riser even though the symbol used for the conduit run denotes concealed. Clarify routing with Engineer prior to installation of exposed conduits.
 - 3. For exposed conduit to be installed in unfinished building areas, such as metal buildings with no framed walls, install conduit either parallel with or perpendicular to structural members of the building or structure, except where allowed otherwise by the Engineer.

4. Roof Penetrations:
 - a. The only conduit that may be run on a roof is conduit that serves equipment on that roof.
 - b. Locate sealed roof penetrations so no horizontal runs of conduit are required on the roof.

- M. Sleeve wall Conduit Penetrations:
 - a. Sleeve floor penetrations where through intermediate floors of a building and in other places indicated on the Drawings.
 - b. Material: steel rigid metal conduit or steel pipe securely fastened in place.
 - c. Set sleeves in masonry walls during construction.
 - d. Set sleeves in concrete before placement.
 - e. Extend floor sleeves 2" up except where shown otherwise on the Drawings.
 - f. Waterproof construction sleeves: flanged type.
 - g. Exterior building wall sleeves:
 - 1) Install conduit in center of sleeve.
 - 2) Pack interior and exterior annular space around conduit with plastic backer rod sized to fit annular space in compression as recommended by backing manufacturer.
 - 3) Seal interior and exterior of joint with acrylic polymer sealant:
 - i. DAP, subsidiary of Plough, Inc.
 - ii. or equal.
 - h. Openings required after footings, walls, floors or ceilings constructed shall be provided and grouted at no additional expense to Owner.

- N. Trip Hazard Locations:
 1. Conduit shall not be installed on slabs, walkpaths, decks, sidewalks or floors where it may create a trip hazard. The Engineer shall be the sole judge as to "trip hazard".
 2. Conduits may be installed on concrete surfaces only with written permission from the Engineer.

- O. Conduits installed under floor slabs shall lie completely under the slab with no part of the horizontal run of the conduit embedded within the slab.

- P. Conduit embedded in structural concrete:
 1. Where shown on the Drawings.
 2. No conduit shall be embedded in the walls of tanks or basins below the high water elevation, except when absolutely necessary and where specifically shown on the Drawings.
 3. Set before concrete is poured.
 4. Route in direct line, with bends as large a radius as practical.

5. Anchor all conduits to concrete reinforcing to prevent damage during concrete installation. Do not interfere with concrete reinforcing.
- Q. Expansion joints: where conduit spans building expansion joints or in long duct runs, use expansion fittings and bonding jumpers.
- R. Drainage:
1. Avoid pockets in conduit runs.
 2. Provide suitable drainage fittings in junction boxes at low spots in exposed conduit.
 3. Weep holes not permitted.
- S. Field Cuts and Threads:
1. Cut ends of conduit square with hand or power saw and ream to remove burrs and sharp edges.
 2. Do not use wheel cutter.
 3. Threads cut on job shall have same effective length, thread dimensions and taper as factory-cut threads.
 4. Carefully remove burrs from threads and paint conduit threads with one coat of zinc chromate to male threads.
- T. Conduit ends:
1. Cap spare conduit.
 2. Open conduit ends terminating in trenches, panels or enclosures: plug space around cables with commercial duct-sealing compound.
 3. Cap conduit ends during construction to prevent entrance of foreign material.
- U. Cleaning: clean and swab inside by mechanical means to remove foreign materials and moisture before wires or cables are installed.
- V. Install PVC-RMC in strict accordance with the manufacturer's instructions. Use strap type wrenches. Pipe wrenches are not acceptable. PVC boot shall cover all threads. Leave no metallic threads uncovered. Use touch-up compound as recommended by the manufacturer to cover gouges and bare metal after installation.

3.03 INSTALLATION – ABOVE GRADE CONDUIT

- A. Route conduit parallel and perpendicular to walls.
- B. Route conduit to maintain headroom and present neat appearance.
- C. Route conduit through roof using flashing and sealants.
- D. Support conduit using straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- E. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- F. Group related conduit in parallel runs where practical. Use conduit rack constructed of channel with conduit straps or clamps. Provide junction box with drain fitting at conduit low point, if necessary.
- G. Avoid moisture traps where possible. Provide junction box with drain fitting at conduit low point, if necessary.
- H. Seal conduit which passes through exterior wall penetrations using suitable sealants.
- I. Supports:
 - 1. Hangers, supports or fastenings:
 - a. Provide at each elbow and at end of every straight run terminating in box or cabinet.
 - b. Rigid fastenings spaced maximum of 7' horizontal, 8' vertical.
 - c. Adjustable supports spaced maximum of 7'.
 - 2. Clamps: comply with Section 16190.
 - 3. One-hole straps are to be installed with hole below conduit in horizontal runs.
 - 4. Trapeze hanger:
 - a. Use to support horizontal runs only.
 - b. Install U-bolts at end of each run and at each elbow.
 - c. Install clamps every third intermediate hanger for each conduit.
 - d. Hangers are not detailed but must be adequate to support combined weight of conduit, conductors and hangers.
 - e. Material:
 - i. Aluminum unistrut with stainless steel fittings.
 - ii. As specified in Section 16190.
 - iii. or equal.

- J. CMU Wall Concealment: Coordinate and install conduits concealed in CMU block wall prior to insulation and bond grout installation for attachment to cast-in-place boxes.

3.04 INSTALLATION - BELOW GRADE CONDUIT

- A. Route conduit from point-to-point, unless otherwise noted.
- B. Install top of conduit minimum 24 inches below finish grade for circuits 600 volts and less, unless otherwise noted. Install top of conduit minimum 42 inches below finish grade for medium voltage circuits, unless otherwise noted.
- C. Provide minimum 3 inches side-to-side clearance for conduit containing alternating current power circuits and conduit containing direct current control or instrumentation wiring for parallel conduit in multiple conduit runs.
- D. Stagger joints in multiple conduit runs 6 inches minimum horizontally.
- E. Join nonmetallic conduit (PVC) using cement recommended by conduit manufacturer.
- F. Use factory made chairs/separators to support and separate conduit.
- G. Anchor conduit to prevent movement during concrete placement.
- H. Provide minimum 4 inches, 3000 psi concrete encasement on all sides of conduit, except under concrete slabs, where conduit does not have to be concrete encased.
- I. Use PVC-coated rigid metal elbows and conduit (PVC-RMC) or rigid metal elbows and conduit (RMC) with corrosion protection tape for bends greater than or equal to 15 degrees and vertical risers in underground non-metallic conduit (PVC) runs.
- J. Apply an application of half-lapped corrosion protection tape where rigid metal conduit (RMC) is in contact with earth. Prepare pipe with primer prior to application of tape. Follow manufacturer's application instructions.
- K. Trenching Requirements:
 - 1. Coordinate installation of underground conduits with other outside and building construction work.
 - 2. Do not back-fill underground conduits until they have been inspected.
 - 3. Warning Tapes: Bury warning tapes approximately 18 inches above all underground conduit runs.

4. Where existing roadways, sidewalks, curbing, etc. are encountered. Remove those sections as needed during construction and replace with new sections after back filling so as to match original conditions.
5. Excavations shall be carefully made to avoid unknown underground utilities or utilities which are in a location different from that expected or shown on the Drawings.
6. Grade trenches and place select material to provide uniform trench bottom for conduit support.

L. Raceways utilized for fiber optic cable shall be installed in the following manner:

1. For conduits that are underground all deflections greater than 30 degrees within a 10-foot span shall be in rigid galvanized conduit, and the radius for all deflections shall be not less than 36 inches.
2. Where the conduit run is less than 20 feet, standard radius 90 degree sweeping elbows can be used.
3. Fiber optic cable shall not pass through any condulets that incorporate a 90-degree change of direction.
4. Conduits shall enter any cabinet in a manner that will allow for a logical and professional installation of the fiber optic cable in the cabinet.
5. Where fiber is installed other than underground or outdoors, it shall be installed in "lay in wireway". Wherever possible, lay the fiber cables in, do not pull into place.

3.05 GENERAL CONDUIT APPLICATIONS

- A. EMT: EMT may be used in hollow metal or wood walls and hollow building ceiling spaces of finished locations for conductors of lighting, receptacle, and alarm circuits only.
- B. ENMT:
 1. May be used for 120V lighting and receptacle branch circuits or thermostat circuits concealed in metal stud hollow walls or CMU cavities.
 2. If so used, then the run may also be extended into the cavity above a Tee-bar ceiling with removable tiles (hollow ceiling space).
 3. Do not use for other control or instrumentation circuits.
- C. RMC:
 1. Not permitted underground or concrete embedded unless protected with corrosion protection tape.
 2. Not permitted in corrosive atmospheres as defined by Engineer.
 3. On aluminum handrails, use aluminum RMC supported by aluminum or stainless steel hardware.
 4. Steel RMC may not be used in place of PVC RMC or aluminum RMC where these types are specifically denoted on Drawings.

5. Do not cast aluminum RMC in concrete or use it for sleeves.
6. Aluminum RMC: not permitted in contact with earth.

D. RNMC:

1. RNMC, whether PVC or FRE, may not be used where exposed to direct sunlight, except the use of RNMC product specifically identified as UV Resistant.
2. RNMC of PVC may be used for elbows under any of the following conditions:
 - a. Conductors are small enough and run is short enough so the inside radius of the elbow will not be significantly grooved during pulling.
 - b. Where Elbow is:
 - i. In earth or concrete.
 - ii. Concealed in a wall.
 - iii. Specifically called out as RNMC on the Drawings.
 - iv. Not exposed to sunlight.
 - c. Exposed portion of run is rigidly supported by a wall, strut channel or similar support, such as a riser to control station which is mounted on strut channel near a motor.
3. FRE duct may be used for elbows if the three following conditions are met:
 - a. The manufacturer certifies in writing that neither the pulling line or rope nor the conductors will significantly groove the inside radius during pulling operations.
 - b. The adjacent portion of the run is FRE duct, or is an adaptor between FRE duct and another type conduit, such as where an elbow penetrates a slab and the run becomes exposed.
 - c. The elbow is not exposed to sunlight.

E. Conduit for Duct Banks:

1. DB is allowed only if scheduled below and specifically called for on the Drawings.
2. EB is allowed only if scheduled below and conduit is not identified as PVC RMC on Drawings.
3. RNMC is allowed if conduit is not identified as PVC RMC on Drawings.
4. PVC RMC is allowed for all runs.

F. FMC:

1. Use FMC for the final connection to luminaires in lay-in type ceilings.
2. Not all such FMC runs are shown on the Drawings.
3. No other usage of FMC is allowed unless specifically called for on the Drawings.

G. LFMC:

1. Use LFMC for the final connection to:

- a. Equipment that may vibrate.
- b. Equipment or instrumentation cases or boxes.
- c. Industrial type luminaires that might be temporarily moved or disconnected for maintenance or calibration.
- d. Not all such LFMC runs are shown on the Drawings.

H. Type of Conduit:

- 1. The Drawings show the type of conduit required for certain runs.
- 2. Where the type is not shown, any type listed in 3.07 "SCHEDULE" may be used, subject to NEC restrictions and the above requirements.

3.06 SIZE

A. General:

- 1. The Drawings show the minimum size required for certain conduit runs.
- 2. Where size is not shown, comply with 3.06C at a minimum.

B. If a conduit size has to be increased because a motor or other equipment furnished by the Contractor requires more power (and therefore larger wire and conduit than shown) than the specified motor or equipment, the larger conduit shall be installed at no additional cost to the Owner.

C. Minimum size requirements:

- 1. As required by NEC, but larger if so shown on the Drawings or required below.
- 2. Exterior pole lighting circuits : 3/4".
- 3. 120/208/240V receptacle circuits:
 - a. Last receptacle in run: 1/2".
 - b. Other runs: 3/4".
- 4. 120/208/240V individual branch circuits: 3/4".
- 5. 208 or 240V feeders: 3/4".
- 6. 480V circuits: 3/4".
- 7. 120V control circuits:
 - a. 1/2" minimum.
 - b. 3/4" for ten to twenty 14 AWG.
 - c. 1" minimum for more than twenty 14 AWG.
 - d. Then size by NEC for conductor number.
- 8. Shielded or coaxial cable: 3/4".
- 9. Circuits of special systems: as shown on Drawings or as required in the specification section for the respective system.

SCHEDULE

- A. Above Grade Installation:
1. Size: Per the Drawings, Conduit Schedule, and other sections of this Specifications. Minimum $\frac{3}{4}$ inch, unless otherwise noted.
 2. NEMA 1 or 12 Dry Location or Housing Closed Water Processes, Interior Area Type (as identified on Drawings):
 - a. Lighting, Receptacle, HVAC Control, and Access Alarm Circuits: Electrical Metallic Tubing (EMT) and fittings.
 - b. All Other Applications and Locations Not Mentioned Above: Rigid Metal Conduit (RMC) and Fittings.
 3. NEMA 4X Wet/Corrosive Interior or Exterior Area Type (as identified on Drawings):
 - a. Lighting, Receptacle, HVAC Control, and Access Alarm Circuits: PVC Jacketed Rigid Metal Conduit (PVC-RMC) and fittings.
 - b. All Other Applications and Locations Not Mentioned Above: PVC Jacketed Rigid Metal Conduit (PVC-RMC) and Fittings.
 4. CMU Block Wall / Exposed Trusses Building Type Installation Procedure:
 - a. Lighting, Receptacle, and Intrusion Alarm Circuits: Conceal conduit in CMU block wall for attachment to outlet boxes associated with receptacles, light switches, wall-mounted light fixtures, and intrusion switches. Conduit for light fixtures supported from roof trusses shall be run exposed within and supported from the webs of the trusses.
 - b. All Other Applications and Locations Not Mentioned Above: Route conduit exposed on interior CMU walls.
 5. Hollow Stud Wall / Suspended Ceiling Building Type Installation Procedure:
 - a. Lighting, Receptacle, and Intrusion Alarm Circuits: Conceal conduit in stud wall for attachment to outlet boxes associated with receptacles, light switches, wall-mounted light fixtures, and intrusion switches. Conduit for light fixtures supported from suspended ceiling shall be run concealed within ceiling and supported from the webs of the joists.
 - b. All Other Applications and Locations Not Mentioned Above: Route conduit concealed within interior of stud walls.
 6. Metal Building with Exposed Frame Wall / Rafter Building Type Installation Procedure:
 - a. Lighting, Receptacle, and Intrusion Alarm Circuits: Conduit shall be run exposed for attachment to outlet boxes associated with receptacles, light switches, wall-mounted light fixtures, and intrusion switches. Conduit for light fixtures supported from roof joists shall be run exposed within and supported from the rafters with appropriate anchored supports.

- b. All Other Applications and Locations Not Mentioned Above: Route conduit exposed on interior wall frame horizontal and vertical members with appropriate anchored supports.
 - 7. Metal Building with concealed Frame Wall and exposed Rafter Building Type Installation Procedure:
 - a. Lighting, Receptacle, and Intrusion Alarm Circuits: Conceal conduit in stud or framed wall surface for attachment to outlet boxes associated with receptacles, light switches, wall-mounted light fixtures, and intrusion switches. Conduit for light fixtures supported from roof joists shall be run exposed within and supported from the rafters with appropriate anchored supports.
 - b. All Other Applications and Locations Not Mentioned Above: Route conduit concealed within interior stud walls.
 - 8. Pre-Cast or Cast-in-Place Concrete Wall Basin/Vault Structure above maximum water level Installation Procedure:
 - a. Power, Control, Lighting, Receptacle Circuits: Route PVC-RNMC conduit embedded and anchored to concrete reinforcement. Install PVC-RMC conduit for all vertical or horizontal elbows beyond 15 degrees, and all concrete entrances/exits exposed for attachment to NEMA 4X rated boxes associated with receptacles, motor starters/disconnects, submersible cord/conduit connections, and switches.
 - b. All Other Applications and Locations on exterior wall surface (and as identified in Drawings): Route RMC coated per 09901, and mounted on stainless steel metal framing channels anchored to concrete walls.
- B. Below Grade Installation:
 - 1. Size: Per the Drawings, Conduit Schedule, and other sections of this Specifications. Minimum $\frac{3}{4}$ inch, unless otherwise noted.
 - 2. Buried Type: Schedule 40 non-metallic conduit (PVC), unless otherwise noted, and concrete encased where noted, except under concrete slabs.
 - 3. NEMA 4X Wet/Corrosive Interior Area Type (as identified on Drawings):
 - a. Power, Control, Lighting, Receptacle, HVAC Control, and Access Alarm Circuits: PVC Jacketed Rigid Metal Conduit (PVC-RMC) and fittings.
 - b. All Other Applications and Locations Not Mentioned Above: PVC Jacketed Rigid Metal Conduit (PVC-RMC) and Fittings.
 - 4. NEMA 4 Damp Interior Area Type (as identified on Drawings):
 - a. Lighting, Receptacle, HVAC Control, and Access Alarm Circuits: Rigid Metal Conduit (RMC) and fittings.
 - b. All Other Applications and Locations Not Mentioned Above: Rigid Metal Conduit (RMC) and Fittings.
 - 5. Pre-Cast or Cast-in-Place Concrete Wall / Roof Vault Structure with Dry Interior Process Piping Installation Procedure:

- c. Power, Control, Lighting, Receptacle, and Intrusion Alarm Circuits: Route PVC-RMC conduit exposed for attachment to NEMA 6P rated boxes associated with receptacles, light switches, wall-mounted light fixtures, cord/conduit connections, and intrusion switches. Conduit for light fixtures supported from roof beams shall be run exposed within and supported from beam attachments. Provide conduit sleeves and compressed flexible annular sealing systems.
 - d. All Other Applications and Locations Not Mentioned Above: Route conduit exposed and attached to interior concrete wall surface.
 - 6. Cast-in-Place Concrete Wall / Roof Building Type with Partially/Fully Submerged Interior Installation Procedure:
 - a. Lighting, Receptacle, and Intrusion Alarm Circuits: Not allowed.
 - b. Power and Control Circuits: PVC Jacketed Rigid Metal Conduit (PVC-RMC) and Fittings with cord connections and conduit seal-offs.
 - c. All Other Applications and Locations Not Mentioned Above: Route conduit exposed and attached to interior concrete wall surface.
- C. Liquidtight Flexible Metal Conduit: Use for connection to motor, motor operated valves, dry-type transformer, mechanical equipment, instrumentation, and devices which produce vibration. Restrict maximum length to 36 inches.

END OF SECTION

SECTION 16124

WIRE CONNECTORS AND ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Wire connectors and splice kits, terminal blocks, wiring duct and cable pedestal.

1.02 SUBMITTALS

- A. Section 16010: General Electrical Requirements.
- B. Complete manufacturer's catalog cuts.

PART 2 PRODUCTS

2.01 600V WIRE NUTS

- A. For splices on conductors 8 AWG and smaller.
- B. Color-coded outer shell; steel inner shell.
- C. Expandable spring type; removable by twisting in reverse.
- D. UL listed and CSA certified for:
 - 1. 600V maximum building wire.
 - 2. 1000V maximum fixture wire.
 - 3. 105° C maximum temperature rating.
- E. PVC insulated.
- F. Manufacturer:
 - 1. Ideal Industries Wing Nuts.
 - 2. or equal.
- G. Use only for wire types and combinations recommended by the manufacturer.
- H. For splices in locations defined in 2.02C below, wire nuts are not acceptable.

2.02 BUTT CONNECTORS

- A. For splices on 120/240/480V circuit conductors 10 AWG and larger (except at motors).
- B. Non-insulated, brazed seam, compression type.
- C. Insulation method for butt splices that may become submerged, such as in manholes, handholes, underground pull boxes, wet wells and in other places noted on the Drawings:
 - 1. Tubular, prestretched EPDM rubber cold shrink insulators which are supplied on a removable, collapsible core for easy installation.
 - 2. Manufacturer:
 - a. 3M PST.
 - b. or equal.
- D. Insulation method for other butt splices.
 - 1. Same as 2.02C.
 - 2. Cover with half lapped Scotch 33+, then with Scotch 5300 Series in-line kit or equal.

2.03 MOTOR LEAD CONNECTORS

- A. Solid wire: 600V wire nuts, paragraph 2.01.
- B. Stranded wire:
 - 1. Install non-insulated ring terminal compression lugs on each conductor, then bolt together.
 - 2. Insulate with Scotch 5300 Series pigtail kits or equal.

2.04 TAP CONNECTORS

- A. For gutter taps.
- B. Use only where called for on Drawings.
- C. Compression type:
 - 1. Hydraulically compressed.
 - 2. Figure C or Figure 3 type.
 - 3. Specifically selected for the proper AWG:
 - a. Brundy "Crimpfit".
 - b. or equal.

- D. Insulation:
 - 1. Scotch 85-XX Multi-Mold splicing kit.
 - 2. or equal.

2.05 DIRECT BURY SPLICE KIT

- A. Use for splices in 24 VAC sprinkler controller conductors located in underground boxes or direct buried, and where called for on the Drawings.
- B. Gel-filled polypropylene insulator tube with locking fingers for wire nuts and strain relief cover.
- C. Manufacturer:
 - 1. 3M DBY.
 - 2. or equal.

2.06 POURED POLYURETHANE SPLICING KIT

- A. Use for:
 - 1. Splicing of direct burial signal cable (Section 16123).
 - 2. Where called for on the Drawings.
 - 3. For other applications where called for on the Drawings.
 - 4. Where proposed in writing by the Contractor and approved by the Engineer.
- B. Snap-together, two-piece translucent plastic mold body.
- C. Connections:
 - 1. Stranded wire: insulated, compression-type butt connectors.
 - 2. Solid wire: solder and heat-shrink sleeves.
- D. Spacer web to keep splice bundle away from mold body and allow a minimum of ¼" of sealing compound to flow readily between the splices and the body.
- E. Jumper wire for shield.
- F. Two-part, low-viscosity polyurethane sealing compounder.
- G. Manufacturer:
 - 1. 3M Scotchcast series 72-N with Scotchcast 2104 compound.
 - 2. or equal.

2.07 RE-ENTERABLE POURED URETHANE SPLICING KITS

- A. Use for:
 - 1. Splicing of direct burial signal cable (Section 16123).
 - 2. Where called for on the Drawings.
 - 3. Other applications where called for on the Drawings.
 - 4. Where proposed in writing by the Contractor and approved by the Engineer.
- B. Two-piece, transparent, PVC-mold body.
- C. End caps with graduated openings for two cables per end.
- D. Connections:
 - 1. Stranded wire:
 - a. Insulated compression-type butt connectors.
 - b. Wye connectors for taps.
 - 2. Solid wire: solder and heat-shrink sleeves.
- E. Spacer web to keep splice bundle away from mold body and allow a minimum of ¼" of sealing compound to flow readily between the splices and the body.
- F. Strain relief bar and shield connector kit.

2.08 HEAVY DUTY TERMINAL BLOCKS

- A. Voltage rating: 600V UL.
- B. Material: nylon with elevated marking strip.
- C. Spacing: ½" center-to-center.
- D. Contacts:
 - 1. Electrical grade copper alloy.
 - 2. Tubular clamp type.
- E. Wire range: #18 to #6 AWG.
- F. Maximum service temperature: 125 degrees Celsius.
- G. Manufacturer:
 - 1. Square D.
 - 2. or equal.

2.09 ULTRA HEAVY-DUTY TERMINAL BLOCKS

- A. Voltage rating: 600V UL.
- B. Material: phenolic with painted marking area.
- C. Spacing: 1.19" center-to-center.
- D. Contacts:
 - 1. Electrical grade copper alloy.
 - 2. Tubular screw type.
 - 3. 270A.
- E. Wire range: 6 AWG to 250 MCM.
- F. Maximum service temperature: 150°C.
- G. Manufacturer:
 - 1. Square D.
 - 2. or equal.

2.10 WIRING DUCT

- A. UL-rated as self-extinguishing with a continuous-use temperature of 55°C.
- B. Rectangular cross-section with rounded returns on tops of fingers.
- C. Cover: easy-on/easy-off, with rounded shoulder to easily grip the duct.
- D. Manufacturer:
 - 1. Panduit Inc.
 - 2. or equal.

2.11 DIN RAIL-MOUNTED CONTROL TERMINAL BLOCKS

- A. General:
 - 1. Thermoplastic insulator housing with marker channels, funnel wire guides and flexible universal mounting foot for DIN1 asymmetrical and DIN3 symmetrical rails.
 - 2. Compression clamp terminal connections with recessed, captive, self-locking screws.

- B. Terminal blocks, 600V rating:
1. DC digital and analog signals: 6mm spacing (0.238") for 22-12 AWG wire.
 - a. DC positive or supply: grey body, Entrelec M4/6, or Engineer approved equal.
 - b. DC negative or return: blue body, Entrelec M4/6N, or Engineer approved equal.
 2. DC shield and drain wire: 6mm spacing.
 - a. Terminals insulated from ground: yellow body, Entrelec M4/6, or Engineer approved equal.
 - b. Terminals grounded to rail: yellow body with green stripe, Entrelec M4/6P, or Engineer approved equal.
 3. AC signal or power: 8mm spacing (0.315"), for 22-8 AWG wire.
 - a. AC hot or switched supply: grey body, Entrelec M6/8, or Engineer approved equal.
 - b. AC neutral or return: blue body, Entrelec M6/8N, or Engineer approved equal.
 4. AC foreign voltage where circuits remain live after opening of control voltage disconnect switch: 8mm spacing (0.315"), orange body, Entrelec M6/8, or Engineer approved equal.
 5. AC equipment ground, terminals grounded to rail: 8mm spacing (0.315"), yellow body with green stripe, Entrelec M6/8P, or Engineer approved equal.
- C. Switch terminal blocks:
1. DC: 6mm spacing (0.238"), short hinged blade, grey body, orange blade, Entrelec M4/6SN, or Engineer approved equal.
 2. AC: 8mm spacing (0.315"), long hinged blade, grey body, grey blade, Entrelec M6/8SNB, or Engineer approved equal.
- D. Fuse-holder terminal blocks:
1. DC or AC: fused switch style, for 6.35mm x 32mm (1/4" x 1 1/4") fuses, 13mm (0.512") spacing, with blown fuse indicator for appropriate voltage per paragraph E2 below, Entrelec M10/13TSFL, or Engineer approved equal.
 2. Blown fuse indicators: one of a, b or c below, as appropriate for the voltage at the terminals.
 - a. For 24 VDC.
 - b. For 48 VDC.
 - c. For 120-277 VAC.
- E. Accessories:
1. Mounting rails: bichromated, zinc plated steel.
 2. Either a or b below, or as specified on the Drawings.
 - a. DIN1 asymmetrical.
 - b. DIN3 symmetrical.

3. End sections for blocks: required on the open extremity of each size and style of terminal block, Entrelec FEM series, or Engineer approved equal.
 4. Circuit separator: required between blocks of different voltages, power and control, AC and DC, Entrelec SCM series, or Engineer approved equal.
 5. End stops for rails: required at the extremities of each series of terminal blocks, Entrelec BAM series, or Engineer approved equal.
 6. Jumpers: required for jumpering between blocks; either a or b below, or as specified on the Drawings.
 - a. Comb type: Entrelec PC with EIP insulating tips, or Engineer approved equal.
 - b. Bar type: Entrelec BJ series with appropriate parts and insulators, or Engineer approved equal.
 7. Protecting covers: required for AC power circuit terminal blocks, Entrelec EPD61 and VSPD61 screws, or Engineer approved equal.
- F. Markers: required for every terminal block and board.
1. Terminal block:
 - a. Side mount, preprinted vertical or horizontal to match board alignment, Entrelec RC, RB or RS, or Engineer approved equal.
 - b. Coordinate abbreviations of text with Engineer if descriptor exceeds available space.
 2. Terminal board: end stop marker holder, Entrelec PEB series, or Engineer approved equal.
- G. Test devices and plugs: provide during testing and leave with the project spares the following items:
1. Screw head test receptacle for 6mm blocks (if used): four each, Entrelec DCJ (yellow), or Engineer approved equal.
 2. Screw head test receptacle for 8mm blocks (if used): four each, Entrelec DCO (orange), or Engineer approved equal.
 3. Test plugs for the above receptacles: eight each, Entrelec FC2, or Engineer approved equal.

PART 3 EXECUTION

3.01 MARKING OF TERMINAL BOARDS AND TERMINALS

- A. Terminal Boards:
1. Engraved Micarta nameplate with ½" letters.
 2. Adjacent to each row or column of terminals.

3. Text: as shown on Drawings or submittals.
- B. Terminal Points:
1. Mark each terminal to be wired.
 2. Mark other terminals if so shown on Drawings.
 3. Text: as shown on Drawings or submittals; if not shown, then match wire number.

3.02 **INSTALLATION, ORIENTATION AND CONNECTION OF DIN RAIL
TERMINALS**

- A. Mount switch and fuse-holder terminal blocks so the blades will fall open, with the hinge at the bottom if blocks are mounted vertically (horizontal rail).
- B. Connect switch and fuse-holder terminal blocks so the blade is de-energized, i.e. with voltage on the non-hinged side and return or neutral on the hinged side.
- C. Install DIN rails with empty space for one future block for each 10 installed, except that no rail shall have fewer than four empty spaces for the largest block used.
- D. DIN rails shall be attached every 6".
- E. Other devices such as relays, surge protectors, power terminals and interface modules may occupy the same rail as terminal blocks.

END OF SECTION

SECTION 16130

BOXES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Boxes.

1.02 SYSTEM DESCRIPTION

- A. Furnish and install boxes as required for a complete conduit system.
- B. Furnish and install all covers.

PART 2 PRODUCTS

2.01 BOXES: OUTDOOR AND IN PROCESS AREAS (NEMA 4X)

- A. Stainless Steel.
- B. Cast aluminum, weathertight:
 - 1. Crouse Hinds FS, FD, WAG or similar.
 - 2. Or equal.
- C. Cast aluminum weatherproof type:
 - 1. Where required under Section 16141 in order to mount weatherproof receptacle covers.
 - 2. Where specifically called for on the Drawings.
 - 3. Where specifically proposed in writing by the Contractor and allowed by the Engineer.
 - 4. "Rayntite" as manufactured by Bell Electric or equal.
- D. Copper-free cast aluminum, UL listed for NEC Class 1, Division 1 hazardous areas where installed in such areas.
- E. Copper-free cast aluminum, UL listed for NEC Class 1, Division 2 hazardous areas where installed in such areas.

F. As called out in specific Sections or on the Drawings.

2.02 BOXES: NON-PROCESS INDOOR AREAS (NEMA 12)

A. NEMA 12 unless a different type is called for on the Drawings or in specific Sections.

B. For EMT: galvanized steel, single piece type.

C. For RMC: FS, FD or "Bell".

D. For PVC RMC, RNMC: PVC-coated FS or FD.

E. Same as 2.01A3 where required for devices.

F. Same as 2.01A4 and 5 where in hazardous areas.

PART 3 EXECUTION

3.01 INSTALLATION

A. Boxes: securely supported independently of conduits so that they are level and in vertical and horizontal alignment.

B. Flush boxes: properly flush and aligned with the surface surrounding it.

C. Boxes outside:

1. Accessible.

2. Exception to Article 370-19 of NEC shall not be used.

3.02 CONDUIT CONNECTORS

A. NEMA 4X boxes: watertight hubs.

B. Cast boxes: threaded portion of box.

C. NEMA 12 boxes: "O"-ring type lock nut connectors.

END OF SECTION

SECTION 16141
WIRING DEVICES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Wiring devices.
- B. Covers.

1.02 RELATED WORK

- A. Section 16010: General Electrical Requirements.
- B. Complete manufacturer's catalog cuts.

PART 2 PRODUCTS

2.01 WIRING DEVICES, GENERAL

- A. Totally enclosed molded base and cover.
- B. Back and side wiring feature: positive clamping with screw-activated pressure plate.
- C. Duplex receptacle construction: positive grounding without bonding jumpers.
- D. Color:
 - 1. Red or other special color where called for on Drawings or where manufacturer's standard for device.
 - 2. Ivory in office areas including associated hallways, record closets, electrical closets, bathrooms, training rooms, control rooms and similar areas.
 - 3. Ivory in laboratories.
 - 4. Ivory in MCC rooms and control rooms.
 - 5. Brown in process areas and outdoors.

- E. Manufacturers:
 - 1. Arrow-Hart.
 - 2. Hubbell.
 - 3. Killark.
 - 4. Crouse-Hinds.
 - 5. or equal.

2.02 TOGGLE SWITCHES, GENERAL PURPOSE

- A. Comply with 2.01.
- B. Heavy duty, specification grade, "silent", 20A, 120 - 277V.
- C. Action: as shown on the Drawings.
- D. Manufacturer:
 - 1. Hubbell 1221, 1222, 1223, 1224 series.
 - 2. or equal.

2.03 DUPLEX RECEPTACLES

- A. Heavy duty, specification grade, three-wire grounding type to meet or exceed NEMA WD-1.
- B. Shall be NEMA 5-20R or as shown on the Drawings.
- C. GFI where specified.
- D. Manufacturer:
 - 1. Hubbell 5262.
 - 2. or equal.

2.04 OTHER RECEPTACLES

- A. Heavy duty specification grade as scheduled or as shown on the Drawings.

2.05 DEVICE PLATES

- A. General:
 - 1. Proper for the device(s) installed.
 - 2. Multiple devices shall be covered with one plate.

- B. Flush Boxes:
 - 1. Oversized premium grade lexan or nylon (Hubbell PJ8, for example) in areas defined by 2.01D1, 2 and 4, where boxes for devices are flush.
 - 2. Match device color.
 - 3. Use standard size plate if oversized plate is not manufactured, such as for a four-gang switch plate.

- C. Surface-Mounted Boxes:
 - 1. Standard size premium grade lexan or nylon in areas defined by 2.01D1, 2 and 4, where boxes are surface mounted.
 - 2. Match device color.

- D. Materials:
 - 1. 302/304 Stainless Steel.
 - 2. Hubbell S1.
 - 3. or equal in laboratories per 2.01D3.
 - 4. NEMA 7 in hazardous areas.
 - 5. Weatherproof (2.06) where outdoors and in other locations as noted on the Drawings.

- E. Plates:
 - 1. Telephone plates match other device plates in area.
 - 2. Special plates: as scheduled or as shown on the Drawings.
 - 3. All others:
 - a. Raised galvanized steel on surface boxes.
 - b. 302/304 stainless steel on flush boxes.

2.06 WEATHERPROOF (WP) IN-USE COVERS

- A. Receptacle Covers:
 - 1. Vertical mount:
 - a. Deep, single, self-closing oversized metallic lid.
 - b. UL listed NEMA 3R with a cord connected.
 - c. Meet NEC 410-57.
 - d. Manufacturer:
 - i. TayMac .
 - ii. or equal.

- B. Toggle switch covers: wet location lift cover, self-closing.

- C. Boxes used with weatherproof covers: specifically designed for and recommended by manufacturer of cover for use with weatherproof cover.

PART 3 EXECUTION

3.01 MOUNTING

- A. Mount inside non-process area duplex receptacles with the "U" ground down, and at 18" centerline above the floor unless otherwise shown on the Drawings.
- B. Outdoor and Process Areas:
 - 1. Mount outdoor and process area duplex receptacles in the horizontal position so that weatherproof covers fully protect the receptacle when the cover is open.
 - 2. Mount at 30" nominal above finished grade or floor unless otherwise shown on the Drawings.
- C. Mount toggle switches at 48" centerline above the floor unless otherwise shown on the Drawings.

END OF SECTION

SECTION 16310

PHOTOVOLTAIC SYSTEM NON-GRID TIED

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The Contractor shall furnish, install, and place into successful operation a stand-alone solar photovoltaic (PV) power systems designed to maintain a year round, constant nominal 24 Volt DC source for the power needs of a vault mounted flow meter with remote mounted amplifier. The system shall have battery charging capabilities controlled and monitored by a charge/load controller located within an outdoor-rated battery/control enclosure, and will not be connected to utility service. The system shall be designed to provide power to installed components for 5 complete days (120 hours) in the event of charging component failure.
- B. The entire system shall be constructed in strict accordance with the latest published UL, NEMA, IEEE, NEC and ANSI standards. All control hardware and software shall be completely factory assembled, wired and thoroughly tested prior to shipment.
- C. All of the equipment listed herein shall be furnished by a single supplier with not less than ten (10) years experience in furnishing comparable systems. The supplier shall be responsible for the correct operation of the equipment as specified after installation.

1.02 CODES AND STANDARDS

- A. The remote PV system and its installation and on-site testing shall conform to the requirements of the following codes and standards:
 - 1. IEEE446 – Recommended Practice testing of standalone photovoltaic systems.
 - 2. NEC – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 600.
 - 3. UL1703. The photovoltaic panels shall be UL1703 listed and labeled.
 - 4. IECTC82, Solar Photovoltaic Energy System.
 - 5. ASTM E44.09, Photovoltaic Electric Power Conversion.

1.03 GENERAL

- A. Major components of this system shall include the specified materials, equipment, and installation required to implement a complete and operational remote PV system.
- B. In order to achieve standardization for appearance, operation, maintenance, spare parts and manufacturer's service, to the greatest extent possible, like items of equipment provided hereunder shall be the end products of one (1) manufacturer.
- C. Not less than fifty percent (50%) of all equipment shall be standard catalogued products of the system supplier to assure one source responsibility, proper system interconnections and reliable, long term operation. The supplier shall provide all equipment and employ full-time manufacturing, engineering, service and support personnel necessary to provide and support the complete system.

1.04 RESPONSIBILITY FOR COMPLETE SYSTEM

- A. The Contractor shall be responsible for and shall provide for the: design, supply, delivery, installation, certification, calibration and adjustment, testing and startup, Owner staff training, warranty and routine future field services, of a complete coordinated system which shall perform per the specified functions.
- B. The Contractor shall provide complete design calculations demonstrating the ability of the system to provide power to installed equipment for 5 complete days with no charging capability.
- C. The Owner and the Engineer will review system technical information as submitted by the Contractor for complete compliance with these specifications.
- D. The Contractor shall provide the Owner with all services and hardware to ensure that the remote PV system shall perform per the specified functions.

1.05 PRIOR APPROVAL OF ALTERNATE SUPPLIER

- A. General:
The system supplier is specified in paragraph 2.02 of this specification. Bidders wishing to utilize an alternative system supplier must submit to the Engineer a request for substitution no less than 10 days prior to bid opening. Any alternative system supplier approved as equal will be listed in an Addendum to the bidding documents. Bidder's request for substitution shall include the following:
 - 1. Include a complete Table of Conformance to each and every paragraph or part of the specifications. Use a chart format with specification part

identified, indicate whether each part is in compliance, a deviation or an exception to the specific part. If an exception or deviation, include a narrative description as to how the deviation or exception can benefit the end-user of the system over that item specified.

2. Provide a block diagram of the proposed system showing all major components and their interconnections and interrelationships. Label each diagram and indicate all external power interfaces. All diagrams shall be in an 11" by 17" sheet format.
3. Provide an equipment list with descriptive literature and specifications for the proposed system. Included on the list shall be all major hardware items. List shall include as a minimum, the manufacturer, the quantity provided, and model numbers for each.
4. Provide a tentative construction schedule for completion of the project within the specified Contract period. Indicate the following activities with milestones: submittal preparation, submittal review, equipment procurement, equipment assembly, system configuration, factory testing, system delivery, system installation, startup, field testing and training, and post acceptance routine service intervals.
5. Describe the system supplier's provisions for service, technical assistance and re-placement parts for the proposed system. Include the system supplier's telephone number. Identify with resumes, all personnel who will be providing technical support services for the project after it is accepted.
6. Alternate approval does not exempt the Contractor from meeting all the requirements of the Contract Documents nor does it give any prior acceptance of any equipment, or services. The Contract Documents are the final authority for acceptance of the work provided. The Alternate Supplier approval submittal is not a part of the contract documents and as such does not exempt the Contractor from the requirements of providing contract submittals described hereinafter.

1.06 QUALITY ASSURANCE

1. Testing Agency Qualifications: A testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be a full member company of the International Electrical Testing Association (NETA).
Testing Agency's Field Supervisor Qualifications: A person currently certified by the NETA National Institute for Certification in Engineering Technologies to supervise onsite testing specified in Part 3.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
1. The Terms "Listed and Labeled": As deemed in the "National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as deemed in OSHA Regulation 1910.7.
- C. Comply with NFPA 70 "National Electrical Code" for components and installation.

1.07 SUBMITTALS

- A. Hardware Submittals:
Before any components are fabricated, and/or integrated into assemblies or shipped to the job site, furnish to the Engineer for their review six (6) copies of submittal documents. Submittals shall include full details, shop drawings, catalog cuts and such other descriptive matter and documentation as may be required to fully describe the equipment and to demonstrate its conformity to these specifications. Specifically, the Contractor shall submit the following materials:
1. Block diagram and operational description of the system showing all major components and their interconnections and interrelationships. Label each diagram and specify all external power interfaces. All diagrams shall be in an 11" by 17" sheet format. Required documentation sets shall be furnished in bound hardcopy and final documentation shall also be provided in electronic format on CD.
 2. Drawings of equipment to be supplied shall include, as a minimum: overall dimension details for each panel, console, etc., including internal and external arrangements and door mounted operator devices with nameplate designations, where specified. Wiring diagrams of equipment including field device connections shall be included and specific installation/wiring requirements identified.
 3. Operational Description shall include the principal functions/capabilities of the system as provided and configured.
 4. Provide a detailed Bill of Materials along with descriptive literature identifying component name, manufacturer, model number, and quantity supplied.
 5. Provide a complete and detailed battery bank size calculation.
- B. Test Outlines and Procedures Submittals:
1. Test descriptions shall be in sufficient detail to fully describe the specific tests to be conducted to demonstrate conformance with this specification.
- C. Spares and Expendable Recommendations:
1. The Contractor shall provide a list of recommended spares and expendable items. The list shall be exclusive of any spares furnished under this Contract. A total purchase cost for the recommended list shall be provided in addition to the unit cost for each item.

D. Warranty as defined by Section 1.13.

1.08 ON SITE SUPERVISION

- A. The Contractor shall provide experienced personnel to supervise, perform, and coordinate the installation, adjustment, testing, and startup of the remote PV system. The personnel shall be present on-site as required to effect a complete and operating system.

1.09 TESTING AND STARTUP

- A. All elements of the remote PV system shall be tested to demonstrate that the total system satisfies all of the requirements of this Specification. The Contractor shall provide all special testing materials and equipment. The Contractor shall coordinate and schedule all of his testing and startup work with the Owner. As a minimum, the testing shall include both a factory test and field test. Testing requirements are as follows:
 - 1. Factory Tests:
 - 2. The associated hardware shall be tested at the factory, prior to shipment, so as to demonstrate that each component is operational and meets the requirements of these specifications. Witnessed factory tests shall be performed on the complete system. Each function shall be demonstrated to the satisfaction of the Owner. Test results shall be certified, with written documentation provided to the Owner upon test completion.
 - 3. Field Tests:
 - a. All system components shall be checked to verify that they have been installed properly and that all terminations have been made correctly.

1.10 TRAINING

- A. The training program shall educate operators, maintenance, engineering, and management personnel with the required levels of system familiarity to provide a common working knowledge concerning all significant aspects of the system being supplied. The training program shall consist of one 8-hour day.

1.11 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall provide two (2) complete sets of hard-covered ring bound loose-leaf O&M manuals and one (1) CD with electronic version of O&M. In addition to “as-built” system drawings, the manuals shall include internal wiring diagrams and operating and maintenance literature for all components provided under this section.

- B. The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing and maintenance of each component and/or instrument.
- C. The contents of the O&M manuals shall be generally organized as follows:
 - 1. System Hardware/Installation
 - 2. Operation
 - 3. Maintenance and Troubleshooting

1.12 DEFINITION OF ACCEPTANCE

- A. System acceptance shall be defined as that point in time when the following requirements have been fulfilled:
 - 1. All O&M documentation has been submitted, reviewed and approved.
 - 2. The complete remote PV system has successfully completed all testing requirements specified herein and has successfully been started up.
 - 3. All Owner's staff personnel training programs have been completed.
 - 4. Owner/Engineer sign a document indicating remote PV has formally been accepted.

1.13 WARRANTY

- A. The equipment manufacturer shall provide a 1-year equipment warranty. These warranties shall be available in writing directly from any Alternate Supplier manufacturer before contract award. A warranty or service contract from a source other than the manufacturer is not an acceptable substitute. The warranty shall provide for direct on-site replacement of equipment or components. The manufacturer shall provide personnel to perform the warranty service, at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 GENERAL

- A. The functions and features specified herewith are the minimum acceptable requirements for the remote PV system. The provided system shall equal or exceed each requirement.

- B. In some cases, the specifications may allow the accomplishing of certain functions by means of more than one hardware/software approach. Any approach that is proposed shall equal or exceed all functional, operational, convenience and maintenance aspects of the one described.
- C. Major equipment and component items are specified; however the Contractor shall provide all appurtenant items necessary to achieve the required operation as hereinafter specified.
- D. The naming of a manufacturer in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment. Rather, the intent is to establish a design basis for the material used, and to indicate a principle of operation desired.

2.02 ACCEPTABLE SYSTEM SUPPLIER

- A. Consolidated Solar Tech, 1310 Monterey Drive Suite A, Santa Fe NM 87505. 505-982-9044.

2.03 FUNCTIONAL REQUIREMENTS

- A. General
 - 1. The contractor shall supply a turn-key remote PV system. The system shall be designed to operate automatically with no need for operator intervention under normal conditions. With normal daylight illumination, the PV array shall be capable of producing sufficient voltage and current to charge the battery bank. The “charging” light shall indicate the battery is being charged by the PV array. When the battery voltage reaches the pre-set charge termination voltage, the controller shall disconnect the array current; preventing overcharging of the battery and the charging light will turn off. In time the battery voltage will decrease below the pre-set charge resumption voltage and the controller shall allow the battery to charge and turn on the charging light. As the battery becomes more fully charged, the controller will pulse current into the battery to achieve and maintain full charge. The charging light will turn on and off during this period. The remote PV system shall be supplied by a single supplier to ensure equipment continuity and single source responsibility.
 - 2. PV system equipment shall be provided as identified within the Drawings and as summarized:
 - a. One (1) rigid frame 100 Watt, 24 VDC PV Module with class II wiring.
 - b. Sealed deep cycle gel cell battery bank, 24VDC maintenance free. The amp-hour ratings of the individual batteries forming the complete battery bank shall sum to a minimum of 550 amp-hours

- c. One (1) 10 Amp 24 VDC solar charge controller with a low voltage load disconnect.
- d. One (1) Outdoor battery/control enclosure, vented, lockable, insulated, with all system wiring

B. Typical Remote PV System (Non-Grid Tied)

- 1. The contractor shall supply a remote PV system for the typical meter vault site. The equipment shall be furnished in a NEMA 4 chest style battery enclosure that shall be vented, lockable and designed to be mountable on a concrete pad, pier blocks, or Unistrut supports. Enclosure shall include circuit breakers, electrical surge protection, power supplies, heaters and all equipment necessary to provide the desired operations at this location.
- 2. The unit shall be furnished completely assembled and tested for providing sufficient power for the linear LED lighting system. The solar panels shall be mounted on the top of the system enclosure in a horizontal position.
 - a. The solar power system shall have as a minimum required solar panels, mounting structure, solar module interconnection cables,
 - b. 24 volt charger/regulator, batteries, and battery interconnect cables. The system shall be self contained in the above mentioned enclosure with the exception of the solar panels and mounting equipment.
- 3.
 - a. Unit shall include battery sized to allow for continued operation during low light conditions, at night, or during a solar panel failure. Batteries shall be sized to allow five (5) continuous days of battery-backed operation.

2.04 COMPONENT SPECIFICATIONS

A. PV Module System

- 1. General:
 - a. The PV module system shall be based on a robust, field proven, current technology hardware platform allowing utilization of the latest advances in technology.
 - b. The PV module shall not require any specialized tools for removal of each unit.
 - c. The PV modules shall meet national and international safety standards including UL 1703, NEC, CSA, CE, DNV and Class C fire rated.
 - d. The PV module cells shall be constructed of Monocrystalline silicon, with a cell configuration of 72 in series.
 - e. The PV modules shall have a lead wire with MC Connector as the type of output terminal.
 - f. The PV modules shall have the following electrical characteristics:
 - i. Module type: Schott Perform Poly 230
 - ii. Nominal Power [Wp] (P_{mmp}) of ≥ 230

- iii. Voltage at nominal power [V] (V_{mpp}) of 30.0
- iv. Current at nominal power [A] (I_{mpp}) of 7.66
- v. Open-circuit voltage [V] (V_{oc}) of 36.9
- vi. Short-circuit current [A] (I_{sc}) of 8.33

- 2. Acceptable Component Manufacturers
 - a. SCHOTT Solar PERFORM Poly 230
 - b. Engineer approved equivalent.

B. Charge and Lighting Controller System

1. General

- a. The charge controller system shall be a 100% Solid State in which all power switching is done with FETs, no mechanical relays shall be used in the charge controller system. System shall have battery charge regulation that use an advanced series PWM charge control for constant voltage battery charging.
- b. The charge controller system shall have temperature compensation in which a sensor measures ambient temperature conditions and corrects the constant voltage set point -56 mV per $^{\circ}\text{C}$ with a 25°C reference. This correction shall matches the battery charging to the changing electrochemical properties of the battery.
- c. The charge controller system shall have low voltage disconnect (LVD) that automatically disconnects the load as an option. If the battery shall fall below 23.0 volts, the load shall be automatically disconnected from the battery to protect against any harmful deep discharges the battery may experience. Unit shall have as an option a 2-second delay that shall prevent any load disconnects from transients. The load shall be automatically reconnected when the battery voltage recovers to 25.2 volts.
- d. If the battery is disconnected during the daytime, the PV array shall continue to provide power to the charge controller system. The charge controller system shall immediately go into MPPT and provide power at a constant voltage to the load. This shall continue as long as power is available from the PV array.
- e. The charge control system shall prevent any reverse current, preventing the battery from discharging through the PV array at night.
- f. The charge controller system shall not require any specialized tools for removal of each unit..
- g. The charge controller systems shall meet national and international safety standards including UL, NEC, CSA, and CE.
- h. The charge controller system shall have the following electrical characteristics:
 - i. Rated Solar Input 10/20A
 - ii. Rated Load Load 10/20A
 - iii. 25% Current Overload 5 min.

- iv. Regulation Voltage: Sealed Battery 14.1 V
 - v. Regulation Voltage: Flooded Battery 14.4 V
 - vi. Load Disconnect 11.7 V
 - vii. LVD Reconnect 12.8 V
 - viii. Temp. Comp. (mV/°C) -27
 - ix. Self-consumption 8mA
 - i. The charge controller system shall have an operating temperature range of -40°C to +85°C.
 - j. The charge controller shall have an integrated microcontroller for automatic and programmable lighting control functions.
 - k. The charge controller shall detect day and night using PV modules.
2. Acceptable Component Manufacturers
- a. Morningstar Corporation SunLight 10L-24V Charge Controller.
 - b. Engineer approved equivalent.

C. Storage Batteries

1. General
- a. Battery system shall be of sufficient capacity to provide a minimum of five (5) days (unless specified otherwise) of backup power during the night or during low light conditions.
 - b. Storage batteries shall be Thixotropic Gelled Electrolyte batteries that are designed to be have minimal maintenance, and have a shock absorbent thick wall polypropylene case.
 - c. Individual storage batteries shall have a 24hr and 100hr capacity rate of 86 Ahr and 98 Ahr respectively at 77 degrees Fahrenheit, and shall be capable of frequent deep cycles.
 - d. Storage batteries shall be manufactured using high purity lead calcium-tin alloy grids.
 - e. Storage batteries shall have the following electrical characteristics:

Bulk Charge	Max Current (amps)	30% of 20 Hr Rate
Absorption Charge	Constant Voltage	2.35 - 2.40 vpc
Float Charge	Constant Voltage	2.25 - 2.30 vpc
Equalize Charge	Constant Voltage	2.40 - 2.45 vpc
Temperature Coefficient		0.005 mv / C°
 - f. Storage batteries shall be classified as non-hazardous, none restricted for surface transport, and air transportation (IATA A-67), shall be non-spill able, and have be a recombinant battery that prevents escape of hydrogen and oxygen gases.
2. Acceptable Component Manufacturers
- a. Deka Sealed Gel Cell Batteries 8G27-12SC92
 - b. Engineer approved equivalent.

- D. Outdoor Battery/control Enclosure and Wiring
 - 1. General
 - a. The remote PV systems enclosures shall be NEMA 4 for outdoor locations. Enclosures shall be fabricated from a minimum of 14 gauge aluminum (NEMA 4) with a baked enamel finish color matched to meet Owner's specification. Units shall include a single gasketed front door. Full height hinges, locking hasp and door clamping hardware shall be included. All enclosures shall be UL listed. Freestanding structures shall have 3 Point Locking Handles.
 - b. Condensation protection shall be provided. Enclosure shall have a heater which operates continuously to prevent condensation build-up. A freeze protective heater and thermostat shall also be provided at those outdoor locations containing hydraulics or sensitive electronic equipment subject to freezing conditions.
 - c. All wiring shall be in complete conformance with the National Electric Code, state, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required. For ease of servicing and maintenance, all wiring shall be color coded and uniquely numbered. The wire color code and number shall be clearly shown on the drawings, with each wire's color and number indicated.
 - 2. Acceptable Component Manufacturers
 - a. Solar Electric Supply, Inc.
 - b. Engineer approved equivalent.
- E. Spare Parts
 - 1. Fuse. Parts shall be provided in a single package with each component tagged.

PART 3 EXECUTION

3.01 GENERAL

- A. General
 - 1. Coordinate all work with the owner to avoid conflicts, errors, delays during installation, testing, cutover and startup.
 - 2. Install all new equipment in accordance with the manufacturer's instructions and approved submittals.
- B. Labeling

1. Label all field mounted control devices, instrumentation, switches, etc., with tag number and item description.
- C. Calibration, Adjusting and Testing
1. Devices requiring field calibration shall be calibrated in the presence of the Owner's representative and documented.

3.02 SYSTEM INTEGRATOR SUPPLIED SERVICES

- A. Project Management
1. System Integrator shall provide engineering and administrative services necessary to fulfill the requirements of this Specification.
 2. System Integrator shall provide the services of an experienced project manager as the overall coordinator during the course of the project.
- B. Installation and Start Up
1. System Integrator shall provide a skilled technician who shall complete troubleshooting and startup to place the entire system into satisfactory operation. The engineer or technician shall make the necessary inspection of the completed installation, make the necessary final field adjustments, and make program revisions as required for start-up.
 2. Demonstrate proper operation of all system features and functions to Owner and Engineer.
- C. Supplies
1. System Integrator shall provide all expendable items such as lamps, fuses, etc. for system startup, checkout, and during the acceptance test.
- D. Maintenance
1. The system integrator shall have a staff of experienced personnel available to provide service on 24-hour notice.
 2. Such personnel shall be capable of fully testing and diagnosing the hardware and software delivered and of implementing corrective measures.
 3. The System Integrator shall, as a standard provision, make available extended maintenance and warranty agreements subsequent to expiration of the warranty period specified.

END OF SECTION

SECTION 16400

ELECTRICAL SERVICE

PART 1 GENERAL

1.01 WORK INCLUDED

- A.
 - 1. Richards Avenue Vault:
 - a. The Contractor shall install a pole mounted service riser on the nearest power pole to the new vault site as designated by PNM and shall coordinate for secondary side connection to an existing pole mounted transformer nearest to the new vault site as designated by PNM.
 - 2. West Sector Vault:
 - a. The Contractor shall coordinate for secondary side connection to an existing pad mounted transformer nearest to the new vault site as designated by PNM.
- B. Include in the Bid and pay to PNM all charges they require for their participation in outages, or system modifications.
- C. Work on existing and new services is critical to construction phasing and is the sole responsibility of the Contractor for coordination.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 16450

SECONDARY GROUNDING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Circuit and System Grounding
- B. Enclosure and Equipment Grounding System
- C. Overhead Line Grounding
- D. Underground Distribution System Grounding

1.02 SUBMITTALS

- A. Submit the following in accordance with the requirements of Sections 01340 and 01700.
 - 1. Catalog Data: Submit catalog data for grounding conductors, grounding clamps, grounding bushings, exothermic weld materials, and compression grounding connector materials.
 - 2. Shop Drawings: Submit shop drawings for signal reference grid fabrication and installation.
 - 3. Project Record Documents: Submit project record documents to include specified certifications and field test reports of installed grounding systems.

1.03 QUALITY ASSURANCE

- A. Furnish and install grounding systems in accordance with ANSI/NFPA 70 - National Electrical Code and this specification section.

PART 2 PRODUCTS

2.01 GROUND ROD

- A. Provide UL listed ground rod(s) as indicated on the Drawings.

- B. Furnish ground rods with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core, approximately 10 feet long, 3/4 inches in diameter.
- C. Manufacturers: Blackburn, Thomas & Betts, Harger.

2.02 GROUND ELECTRODE CABLE

- A. Provide bare stranded, soft temper copper cable that conforms to ASTM B8, Standard Specification for Concentric-Lay Stranded Copper Conductors.

2.03 GROUNDING CONDUCTORS

- A. Provide UL Listed THHN/THWN insulated copper wire.
- B. Use stranded grounding conductors for No. 8 AWG and larger.
- C. Color code grounding conductors as follows:
 - 1. Equipment ground:
 - a. Conductors No. 6 AWG and smaller: Green colored insulation.
 - b. Conductors No. 4 AWG and larger: Black colored insulation with 3/4 inch wide band of water and oil-resistant green plastic adhesive tape.

2.04 GROUND CONNECTORS

- A. Provide UL listed copper alloy connectors with silicon bronze hardware for making cable to pipe connections.
- B. Manufacturers: Burndy, O.Z.

2.05 CONDUIT GROUNDING BUSHINGS

- A. Provide UL listed, galvanized malleable iron, 150 C rated insulated throat grounding bushings with lay-in type ground cable lugs.
- B. Manufacturers: O.Z., Thomas & Betts

2.06 EXOTHERMIC WELD GROUNDING CONNECTIONS

- A. Provide molds and welding material for making exothermic weld connections.

- B. In interior locations and in vaults, use low smoke emission type welding material.
- C. Match mold and weld material to material types, shapes and sizes to be joined.
- D. Manufacturer: ERICO Cadweld

2.07 COMPRESSION GROUNDING CONNECTIONS

- A. Provide UL listed wrought copper connectors, terminals and splices for making compression grounding connections.
- B. Furnish connectors that have been tested successfully according to the requirements of IEEE Std. 837 - IEEE Standard for qualifying Permanent Connections Used in Substation Grounding.
- C. Provide hydraulic compression tools and dies that match the connectors.
- D. Match connector and die size to material shapes and sizes to be joined.
- E. Manufacturer: Burndy

PART 3 EXECUTION

3.01 GENERAL

- A. Comply with the requirements of ANSI/NFPA 70, this Section and the Drawings.
- B. Clean contact surfaces to which ground connections are to be made. Remove non-conductive coatings such as paint, enamel, oxidation and oil film.
- C. Use the following connection methods unless otherwise specified or indicated on the Drawings:
 - 1. Use exothermic weld grounding connections for underground or concealed connections of dissimilar materials.
 - 2. Use exothermic weld grounding connections for underground or concealed connections of like materials.
 - 3. Use exothermic weld, connections for accessible connections.
- D. Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard

method to make a visible indication that a connector has been adequately compressed.

- E. Install exothermic welds in accordance with manufacturer's instructions and recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- F. Make connections with clean bare metal at points of contact.

3.02 ENCLOSURE AND EQUIPMENT GROUNDING

- A. General: Provide permanent and effective equipment, enclosure, and raceway grounding in accordance with ANSI/NFPA 70, and as further specified or shown on the Drawings.
- B. Provide an equipment ground bar, separate from any neutral bar, in all switchgear, switchboards, panelboards, transformers, motor control centers, starters, disconnect switches, cabinets, etc., for grounding the enclosure and for connecting other equipment and raceway ground conductors. Make connections to the ground bar using mechanical lugs or compression lugs.
- C. Make connections and couplings on metallic conduit systems wrench tight.
- D. Grounding Bushings:
 - 1. Install grounding bushings on metallic conduit containing circuits rated 100 amperes and higher.
 - 2. Install grounding bushings on metallic conduits entering enclosures through concentric, eccentric or oversize knockouts.
 - 3. Install grounding bushings on metallic conduits that terminate to a metallic enclosure without effective electrical connection such as locknuts or threaded bushings.
 - 4. Bond conduit grounding bushing lug to the equipment ground bar or ground lug in switchgear, switchboards, panelboards, transformers, motor control centers, starters, disconnect switches, cabinets, etc. Size bonding jumpers in accordance with ANSI/NFPA 70, Table 250-95.
- E. Provide an insulated equipment grounding conductor for each feeder and branch circuit.
 - 1. Install the grounding conductor within the common conduit or raceway with the related phase and neutral conductors and connect to the box or cabinet grounding terminal or grounding bus.
 - 2. Size equipment ground conductor in accordance with ANSI/NFPA 70, Table 250-122 or as shown on the Drawings.

- F. In each 15 or 20 ampere branch circuit outlet box and junction box, install a green colored washer head grounding screw with a minimum No. 12 equipment grounding conductor pigtail.
- G. Connect receptacle grounding terminals to the equipment ground system using minimum No. 12 AWG equipment grounding conductor. Do not use a "self-grounding" receptacle strap as the only equipment grounding path.
- H. Connect ground lead of low voltage surge arrestor or transient voltage surge suppressor to the equipment ground bar of the protected switchgear, switchboard or panelboard. Make connections as short and straight as practical; follow manufacturer's instructions.
- I. Bond raceways served from cable tray using conduit clamps or grounding bushings that are UL approved for the purpose.
- J. Install an equipment grounding conductor in each cable tray; size conductor per ANSI/NFPA 70, Table 250-122, but not smaller than #6 AWG. Bond grounding conductor to each cable tray section using UL Listed cable tray ground clamps. Connect grounding conductor to ground bus of each enclosure or equipment item served by the cable tray.

3.03 OVERHEAD LINE GROUNDING

- A. General: Comply with ANSI C2, "National Electrical Safety Code" for "Single-Grounded Systems," using two electrodes in parallel if a single electrode resistance to ground exceeds 25 ohms.
- B. Separate lightning arrester grounds from other ground conductors.
- C. Interconnect secondary neutral and tank of transformer and connect to ground.
- D. Protect grounding conductors running on the surface of wood poles with molding of a type manufactured for this purpose. Extend from grade level up to and through communications and transformer spaces.

3.04 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Install a #4/0 AWG bare copper ground cable within the concrete envelope of each power and communications ductbank; connect to ground cable in manholes.
- B. Ground metallic conduit exposed to contact in accordance with the requirements of NFPA 70. Use exothermic welded connections for concealed grounding connections.

- C. Install continuous loop of 4/0 AWG bare copper ground cable around inside walls of each handhole or manhole at floor level.
 - 1. Attach to walls using copper or cast bronze cable holder and masonry anchor.
 - 2. Connect to duct bank ground cable using exothermic welds or approved non-reversible compression fittings.
 - 3. Ground exposed metal parts, such as inserts, cable racks, pulling irons, ladders, cable shields, metallic conduits or duct bell ends to ground cable loop using No. 4 AWG stranded copper wire with exothermic welds or approved non-reversible compression fittings. Train conductors plumb or level around corners and fasten to manhole walls.

- D. Ground non-current-carrying metallic items associated with manholes, substations, and pad-mounted equipment by connecting them to ground cable and grounding electrodes arranged as indicated on the Drawings.

3.05 FIELD QUALITY CONTROL

- A. General: Perform on-site verification, certification and acceptance testing of the grounding installation during construction.

- B. Notify the Engineer ten (10) working days in advance of the expected completion of a grounding system installation. Verification and testing can be scheduled in parts or by area depending on the system and construction schedule.

- C. Acceptance Testing: Perform acceptance testing and submit written reports to the Engineer in accordance with the requirements of Section 16950.
 - 1. Perform ground-impedance measurements using the "fall-of-potential" method in accordance with IEEE 81, Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System. Use instrumentation specifically designed for ground impedance testing as defined in Section 12 of the above guide. Provide sufficient spacing of test electrodes so that the plotted curves flatten in the 62% area of the distance between the item under test and the current electrode. When sufficient spacing of electrodes is impractical for the "fall-of-potential" method, perform ground-impedance measurements using either the "intersecting curves method" or the "slope method", references 40 and 41 in IEEE Std. 81.
 - 2. Ground-impedance maximum values shall be as follows:
 - a. Equipment rated 2500 kVA and less: 5 Ohms
 - b. Equipment rated over 2500 kVA: 1 Ohm
 - c. Unfenced substations and pad-mounted equipment: 5 Ohms
 - d. Manhole grounds: 10 Ohms

3. Test equipment ground resistances for the following items. Measure resistance between the equipment item and the Main Ground Electrode Ground Bar. Use the "two-point method" of IEEE Std. 81.
 - a. Transformers
 - b. Switchgear and Switchboards
 - c. Panelboards
 - d. Generators
 - e. Motor Control Centers
 - f. Motors larger than 1 HP
 - g. UPS Systems

- D. Where ground-impedances or equipment ground resistances exceed specified values, and if directed by the Engineer, modify the grounding system to reduce resistance values.

- E. Prepare test reports, certified by the testing organization, of the ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe any measures taken to improve test results.

END OF SECTION

SECTION 801

INSTALLATION OF WATER TRANSMISSION, COLLECTOR AND DISTRIBUTION LINES

801.1 GENERAL

The water facilities and materials, specified herein, are associated with water transmission, collector and distribution lines.

801.2 REFERENCES

801.2.1 American Water Works Association (Latest Edition) (AWWA):

- C110 American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids
- C203 Coal-Tar Protective Coatings and Linings for Steel Water Pipelines -Enamel and Tape-Hot-Applied
- C206 Field Welding of Steel Water Pipe
- C207 Steel Pipe Flanges for Waterworks Service-Sizes 4 in. through 144 in.
- C502 Dry Barrel Fire Hydrants
- C504 Rubber-Seated Butterfly Valves
- C509 Resilient-Seated Gate Valves for Water and Sewerage Systems
- C600 Installation of Ductile-Iron Water Mains and Their Appurtenances
- C651 Disinfecting Water Mains
- C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution
- C905 Polyvinyl Chloride (PVC) Water Transmission Pipe Nominal Diameter 14 in. through 36 in.
- C909 Molecular Oriented Polyvinyl Chloride (PVCO), Pressure Pipe 4" - 12" for water distribution.
- M9 Concrete Pressure Pipe
- M23 PVC Pipe-Design and Installation

801.2.2 This Publication:

- SECTION 121 PLASTIC PIPE
- SECTION 127 STEEL WATER PIPE
- SECTION 128 CONCRETE CYLINDER PIPE
- SECTION 129 DUCTILE IRON PIPE
- SECTION 130 GRAY IRON AND DUCTILE IRON FITTINGS
- SECTION 340 PORTLAND CEMENT CONCRETE CURBS, GUTTERS, WALKS,DRIVEWAYS, ALLEY INTERSECTIONS, SLOPE PAVING, AND MEDIAN PAVING
- SECTION 343 REMOVAL AND DISPOSAL OF EXISTING PAVEMENT, CURBS, GUTTERS, SIDEWALKS & DRIVEPADS
- SECTION 701 TRENCHING, EXCAVATION AND

BACKFILL

SECTION 1502 SUBMITTALS

801.3 MATERIALS:

801.3.1 GENERAL:

801.3.1.1 The CONTRACTOR shall submit certification from the manufacturer of the pipe as specified in Section 1502 as to the pipe material and that the pipe meets or exceeds the required testing. Only pipe manufactured in the United States of America will be acceptable.

801.3.1.2 Main line pipe and fittings shall be as specified in the Reference Section in this publication as listed above or as specified in the Supplemental Technical Specifications and/or as authorized by the ENGINEER.

801.3.2 PIPE:

801.3.2.2 Limitations of pipe materials versus pipe sizes will be as follows, unless otherwise specified on the plans or Supplemental Technical Specifications:

<u>Pipe Type</u>	<u>Sizes</u>
Ductile Iron	3" thru 64"
Concrete Cylinder(AWWA C303)	16" and larger
Plastic (PVC)	4" thru 20"
Welded Steel Pipe (AWWA 200)	16" and larger

801.3.2.3 The type of pipe used shall be approved by the ENGINEER. Steel pipe will be used only where specified on the drawings. All pipe shall be of domestic manufacture and origin. Unless otherwise approved by the ENGINEER, all pipe installed shall be identical from valve to valve.

801.3.3 GATE VALVES:

801.3.3.1 Gate valves shall only be used for pipe sizes of 12 inches and smaller, unless otherwise noted on the plans or in the Supplemental Technical Specifications.

801.3.3.2 Resilient seat gate valve shall be used and shall conform to AWWA C 509. The gate valve shall be a non-rising stem type with inside screw and "O" ring seals. The valve shall have a standard hub which opens counter-clockwise. Type valve ends shall be mechanical joints, unless otherwise specified on the plans. "O" ring retainer shall be

secured with nuts and bolts.

801.3.3.3 The resilient seat shall be mechanically retained or bonded on the valve gate (wedge disc).

801.3.3.4 All brass or bronze parts used on gate valves shall comply with AWWA C 509.

801.3.3.5 The outside of the valve body shall be painted with coal tar enamel or corrosion-resistant coating. The inside shall be protected with corrosion resistant coating, approved for potable water.

801.3.3.6 The valve stem shall comply with AWWA C 509. The material for the valve stem shall be brass or bronze, and shall have a minimum yield strength of 20,000 psi and minimum tensile strength of 60,000 psi.

801.3.3.7 Gate valves shall have a 2 inch square operating hub nut. Gate valves in vaults with valve covers at ground level shall have a handwheel with the 2" nut welded to the center.

801.3.3.8 Maximum input torque to open and/or close the valve shall be 200 foot pounds for a 4-inch valve and 300 foot pounds for 6-inch under a working pressure of 200 psi.

801.3.3.9 No Project will be accepted by the OWNER until all valves are operational and accessible.

801.3.3.10 Before the Work will be accepted, the CONTRACTOR shall provide the ENGINEER with a completed "Water Valve Data Card", as shown on Pages 801-5 and 801-6. The ENGINEER shall forward the card to OWNER.

801.3.4 RUBBER SEATED BUTTERFLY VALVES:

801.3.4.1 Butterfly valves will be used for sizes of 14 inches and larger, and shall comply to AWWA C 504.

801.3.4.2 Only short body, Class 150B valves are acceptable. Wafer type valves are not acceptable. Valve ends may be either mechanical joint or flanged.

801.3.4.3 The rubber seat shall be field replaceable on valve sizes 24 inches and larger. The rubber seat may be mechanically retained or bonded on the disc or valve body.

801.3.4.4 Butterfly valves shall have a 3 inch square operating hub nut. Butterfly valves in vaults with valve covers at ground level shall have a handwheel with the 3" nut welded to the center.

801.3.4.5 The valve shaft and disc shall be installed horizontally. The valve disc shall pivot and rotate on the horizontal axis.

801.3.4.6 The maximum input torque to open and/or close the valve shall not exceed 150 foot pounds under a minimum working pressure of 150 psi, and the butterfly operator shall be compatible with this pressure. Maximum operating torques shall be in accordance with AWWA C 504, Table 1, Class 150B. The manufacturer of the valve shall be responsible for the operator.

801.3.4.7 No project will be accepted by the OWNER until all valves are operational and accessible.

801.3.4.8 Before the Work will be accepted, the CONTRACTOR shall provide the ENGINEER with a completed "Water Valve Data Card," as shown on pages 801-5 and 801-6. The ENGINEER shall forward the card to the OWNER.

801.3.5 VALVE BOXES: Valve boxes shall consist of Polyvinyl Chloride (PVC) C-900, or High Density Polyethylene Pipe, (HDPE), with corrugated exterior and smooth interior pipe cut to accommodate the required depth. No joints shall be allowed. Pipe diameter shall be 10 inches for valves in paved areas to accommodate the cover and lid specified here-in. The pipe shall be centered and placed true to vertical around the axis of the operating nut. Valve covers and lids for re-use water shall be different than those used for potable water, and shall be as shown on re-use project construction plans.

801.3.6 COMBINATION AIR AND VACUUM VALVES: Air and vacuum valves shall be the type and size shown on the plans.

801.3.7 FIRE HYDRANTS:

801.3.7.1 Fire hydrants and their extensions shall be in accordance with AWWA C 502, traffic type. Fire hydrants shall have one 5 1/4 inch diameter valve opening; 6 inch mechanical joint inlet connection; two 2 1/2 inch hose nozzle connections; and one 4 1/2 inch steamer nozzle with National Standard Fire Hose Coupling Screw Threads. Fire hydrants shall have a bronze or cast iron, pentagon, operating nut, be designed for 150 psi. working pressure service, and have a normal bury of 4 to 4 1/2 feet unless field conditions require a deeper bury, in which case extensions will be used so as to bring the bottom of the break-off flange 2 to 8 inches above the top of finish grade.

801.3.7.2 The pipe fittings and fire hydrants starting at the street main and ending at the fire hydrant itself shall be lying in a line perpendicular to the street's centerline or radially on a curvilinear installation. Fire hydrants shall have no more than 1/2 inch variation from a vertical line between the breakaway flange and the top of the fire hydrant.

801.3.7.4 Hydrants shall be dry barrel, post-type with compression main valve closing with pressure. They shall have a field lubrication capability. Hydrants shall have a bronze seat ring threaded into a bronze drain ring or bronze or cast iron bushing.

801.3.7.5 Exterior of hydrant, below the ground line, shall be coated with asphalt varnish, and the exterior painted from the top to a point one foot below the ground level flange, consisting of one coat rust inhibitive primer and one coat "chrome yellow" enamel. The bonnet shall then be painted with a reflectorized paint using a color as close to "chrome-yellow" as possible.

801.3.7.6 The bottom plate of the main valve shall be epoxy coated. The shoe of the fire hydrant shall have a 6-inch mechanical joint connection and the inside shall be epoxy coated to prevent corrosion. The nozzle shall be threaded in place and retained by stainless steel locks. Hydrant body shall be threaded to receive the threaded nozzle. Nozzle shall be secured by a stainless steel locking device.

801.3.7.7 Fire hydrant shall contain two drain outlets. The drain outlets shall be constructed of bronze. Hydrant shall be provided with a pentagon operating nut to open counter clockwise and shall have an anti-friction washer between the hold-down nut and the operating nut.

801.3.7.8 To prevent loss of brass operating nuts due to theft or vandalism, the following shall be included in or on the fire hydrant:

801.3.7.8.1 Attach OWNER approved anti-theft device to the hydrant; or

801.3.7.8.2 The bonnet must be removed in order to remove the operating nut; or

801.3.7.8.3 Use a cast iron operating nut.

801.3.7.9 Fire hydrants shall be installed at locations as shown on construction plans and in accordance with Standard Detail Drawings.

801.3.7.10 Fire hydrants shall be properly restrained in accordance with Section 130. If mechanical restraint is used, each joint on the hydrant leg shall also be restrained.

801.3.8 PRESSURE REDUCING VALVE (PRV): Pressure reducing valve shall be a globe pattern, flanged end, pressure Class 125. Submittals for approval shall be made to the ENGINEER and approval must be received before installation. The following items are required in the PRV:

801.3.8.1 Materials:

801.3.8.1.1 Main valve-cast iron with brass trim.

801.3.8.2 Pilot Control System:

801.3.8.2.1 Adjustment from 15 psi to 75 psi.

801.3.8.2.2 Shut-off cock on all pilot control system lines.

801.3.8.2.3 Inlet flow strainer.

801.3.8.2.4 Closing speed control.

801.3.8.2.5 Opening speed control.

801.3.8.2.6 Flow stabilizer.

801.3.8.2.7 Tubing shall be copper.

801.3.8.3 Installation shall be as per the construction plans. ENGINEER shall determine final settings on PRV.

801.3.8.4 Before the Work will be accepted, the CONTRACTOR shall provide the ENGINEER with a "Water Valve Data Card". The ENGINEER will forward the card to the OWNER.

801.3.9 TAPPING SLEEVES: (For other than Concrete Cylinder Pipe) For either taps greater than 2/3 line size, or size on size taps 12 inches or less, only approved, long body, fully gasketed tapping sleeves shall be allowed. During installation of the tapping sleeve, the pipe shall be fully supported to support the weight of the tapping sleeve and tapping machine.

801.3.9.1 Tapping sleeves of heavy welded steel bodies shall meet the following requirements:

801.3.9.1.1 Epoxy coated.

801.3.9.1.2 Bolts and nuts to be stainless steel.

801.3.9.1.3 Gaskets to be Buna-N rubber.

801.3.9.1.4 Flange to be flat face steel and comply with AWWA C-207.

801.3.9.1.5 Class D-ANSI 150 lbs. drilling.

801.3.9.1.6 Designed to sustain an operating pressure of 150 psi.

801.3.9.1.7 May be used on all water mains, 4" and larger.

801.3.9.2 Tapping sleeves of cast iron bodies shall meet the following requirements:

801.3.9.2.1 Mechanical joint type with a working pressure of 200 psi .

801.3.9.2.2 Outlet flange to be Class 125, ANSI B16.1.

801.3.9.2.3 Sleeves to include side and end gaskets of Buna-N rubber.

801.3.9.2.4 Eight high strength steel bolts and nuts to secure the halves of the sleeve to the pipe.

801.3.9.2.5 May be used on all water mains, 4" and larger.

801.3.9.3 Tapping sleeves of short sleeve cast iron shall meet the following requirements:

801.3.9.3.1 Working pressure of 150 psi.

801.3.9.3.2 Outlet flange to be Class 125, ANSI B16.1.

801.3.9.3.3 Outlet half to have an enclosed gasket in a groove for a pressure seal.

801.3.9.3.4 Four high strength steel bolts to secure halves of tapping sleeve to the pipe.

801.3.9.3.5 May be used on all water mains, 4" and larger.

801.4 WATER VALVE DATA CARD: Water Valve Data Card, as shown on pages 801-5 and 801-6 shall be prepared for all types of valves (Gate Valves, Butterfly Valves, Pressure Reducing Valves, Air Release Valves, etc.) according to the following instructions.

801.4.1 A Water Valve Data Card will be prepared for each valve installed.

801.4.2 The Valve Number will be assigned by the OWNER at a later date.

801.4.3 Valve Size is the nominal diameter of the valve, i.e., 6-inch, 14-inch or 48-inch. In the case of

compound valves give size of main valve and bypass valve, i.e., 24-inch and 4-inch, or 36-inch and 6-inch.

801.4.4 Valve Type is the general description of the valve, such as: Resilient-Seal Gate Valve, Butterfly Valve, Globe Valve, Check Valve, etc.

801.4.5 Make and Model refers to the manufacturer, make and model number to identify the valve for replacement parts. This information should be available from the shop drawings.

801.4.6 Number of Turns and Direction to Open is the number of revolutions of the operating nut to make the valve travel from fully closed to fully open, and the direction is either clockwise or counterclockwise, i.e., 54 turns counterclockwise. All standard valves shall open counterclockwise. Operation, turn count, and direction to open will be verified by the ENGINEER prior to installation.

801.4.7 Under Project Name is the assigned work order number.

801.4.8 Date Warranty Expires is the expiration date, under the contract, for requiring warranty repairs.

801.4.9 Street Location: Give both Block number and street name. For valves in intersections give both streets, i.e., 5200 San Mateo Blvd. NE and 3000 Candelaria NE.

801.4.10 The section on coordinate location shall be completed with information furnished by the ENGINEER.

801.4.11 All applicable items on the "Water Valve Data Card" should be filled in. However, accuracy is more unknown and cannot be determined, leave the space blank.

801.4.12 Depth to "Operator" is vertical distance from the top of actual valve operating nut to top of valve box cover.

801.5 FIRE HYDRANT DATA CARD
Fire Hydrant Data Card, as shown on page 801-8 shall be prepared for all installations of fire hydrants, according to the following instructions.

CARD NO. 801.4
 WATER VALVE DATA CARD
 (Front Side)

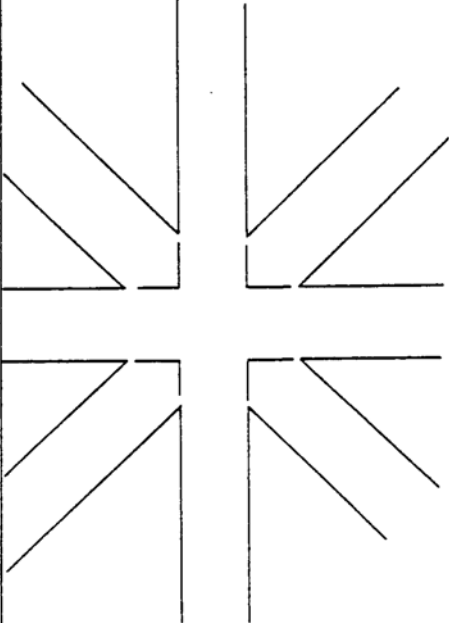
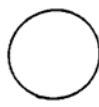
<u>MAP NO.</u>	<u>VALVE NO.</u>	<u>SIZE</u>	<u>TYPE</u> <input type="checkbox"/> -B.F.V. <input type="checkbox"/> -B.V. <input type="checkbox"/> -R.S.G.V.	<u>MAKE</u>	<u>MODEL</u>	<u>PROJECT</u>	<u>EMD</u> <input type="checkbox"/> -YES <input type="checkbox"/> -NO
		<u>URNS</u>					
<u>CHECKED</u>							
<u>DATE</u>							
<u>CREW</u>							

"CHECKED" CODE:
 O - OK L - LOST E - EXTENSION NEEDED C - NEEDS CLEANING
 B - BROKEN M - LID MISSING R - RAISE TO GRADE

WARRANTY EXPIRES _____ DEPTH TO OPER. _____ LOCATION _____
CONTRACTOR _____ EXTENSION LENGTH _____ SKETCH EXACT LOCATION BELOW

NOTES: 1. Available at Water Systems Division.
 2. Size 4 inches x 8 inches.

CARD NO. 801.4
 WATER VALVE DATA CARD
 (Reverse Side)

	<p>REFERENCE SYMBOLS</p> <ul style="list-style-type: none"> ◆ - SUBJECT VALVE ⊗ - OTHER VALVE (S) ○ - PRESSURE REDUCING VALVE ○ - AIR RELIEF VALVE ⊕ - FIRE HYDRANT --- - LINE VALVE IS FOR --- - OTHER WATER LINES 						
<p>INDICATE NORTH BY ARROW</p> 	<p>COORDINATES OF LID</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20px;">X</td> <td style="width: 100px;"> </td> </tr> <tr> <td>Y</td> <td> </td> </tr> <tr> <td>Z</td> <td> </td> </tr> </table>	X		Y		Z	
X							
Y							
Z							

801.5.1 Fire hydrant number will be assigned by the OWNER at a later date.

801.5.2 Fire hydrant type refers to the manufacturer's make and model.

801.5.3 Location. Indicate both block number and street name. At intersections indicate both street names.

801.5.4 Date installed. Indicate actual date the hydrant was installed.

801.5.5 Depth. Indicate the actual depth in feet of the lower barrel of the fire hydrant. This depth is measured from the shoe to the break-away flanges of the hydrant.

801.5.6 On the reverse side of the card indicate the location of fire hydrant on the sketch.

801.6 WATER LINE CONNECTIONS

801.6.1 GENERAL : All new water line tie-ins to the existing water system shall be directly inspected and approved by the ENGINEER. This includes non-pressurized or pressurized connections that will result in extension of the existing system.

801.7 LOCATIONS OF WATER MAINS AND SEWER LINES

801.7.1 Unless otherwise authorized by the ENGINEER, parallel water and sewer lines shall be installed at least 10 feet apart horizontally, and the water line shall be at a higher elevation than the sewer. Separate trenches will be required in all cases (this shall be effective even though one line has been installed prior to the other), and the water line shall be at least 18 inches above the sewer; when water and sewer lines cross each other, the water line shall be at least 18 inches above the sewer; otherwise the sewer shall be of pressure class pipe extending between manholes, or concrete encased for 10 feet on each side of the water line as shown in the Standard Detail Drawings. The crossings shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.

801.7.2 Water mains shall not be constructed under walkways, sidewalks, curbs and gutters, driveways, or similar concrete structures by tunneling underneath them. Trenchless technologies may be allowed with prior approval by the OWNER. The CONTRACTOR will cut these structures by using a concrete saw or, at his option, he may remove and replace the section of the concrete

structure to the nearest full expansion joint or edge.

801.8 TRENCHING AND BACKFILLING

801.8.1 All trenching and backfilling shall be in full accordance with Section 701. The minimum cover over distribution lines shall be 3 feet, and 4 feet of cover over transmission and collector lines.

801.9 GENERAL INSTALLATION ITEMS

801.9.1 Trenching, bedding, and backfilling shall comply with the requirements set forth in Section 701.

801.9.2 Pipe and accessories shall be new and unused and shall be handled in such a manner as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of a pipe or fitting after the coating has been applied.

801.9.3 The interior of the pipe shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during operations by plugging or other approved methods. When work is not in progress, open ends of pipes and fittings shall be securely closed so that no other substances will enter the pipes or fittings. Any section of the pipe found to be defective before or after laying shall be replaced with sound pipe without additional expense to the OWNER.

801.9.4 All nuts and bolts utilized in underground pipe connections shall be stainless steel, high strength cast iron or high grade, high strength steel. The full length of each section of pipe shall rest solidly upon the bed, with recesses excavated to accommodate bells and joints. Any pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipes shall not be laid in water or when trench or weather conditions are unsuitable for the work except by as authorized by the ENGINEER. All unconnected ends of pipes shall have a valve, plug, or cap installed on it.

801.9.5 Pipe shall be laid to line and/or grade shown on the plans or as staked in the field. Changes in horizontal or vertical alignment of the pipe at a joint shall not exceed the manufacturer's recommended deflection for the type and size pipe being laid. When the change required is more than the recommended deflection, a fitting or several short joints of pipe shall be used. PVC pipe may not be deflected at the joints.

CARD NO. 801.5
 FIRE HYDRANT DATA CARD

												FIRE HYDRANT NUMBER											
INSP.																							
REP.																							
CREW																							
DATE																							
TYPE												LOCATION											
DATE INSTALLED												VALVES TO CLOSE FOR REPAIRS											
DEPTH												REMARKS											

FRONT SIDE

Indicate north
by arrow

REVERSE SIDE

801.9.6 When new pipe is to be connected to an existing pipe or when crossing an existing pipe line, the CONTRACTOR shall excavate the existing lines well in advance of the laying of the new pipe line to enable the ENGINEER to verify their elevation and placement and to make any changes in grade and/or alignment of the new pipe line that may be required.

801.9.7 On all push-on-joints (bell and spigot, fluid-tite, and ring-tite) the rubber gasket shall be removed, cleaned, the groove cleaned, the gasket replaced, and the bell or plain end cleaned before jointing. The gasket and the bell or plain end of the pipe to be jointed shall both be lubricated with a suitable soft vegetable soap compound to facilitate jointing. Care shall be taken to insure that neither the bell or collar, or the pipe being jointed is damaged as it is being pushed home.

801.9.8 Flanged and mechanical joints shall be made with machine bolts and nuts of the proper size only. All components of these types of joints shall be cleaned before jointing. Only one (1) gasket will be permitted in a flange joint. In a mechanical joint the plain end pipe shall be fully seated before the gasket and gland is slipped up to the bell. Nuts on both types of joints shall be tightened by alternating nuts 180 degrees apart. The CONTRACTOR shall be responsible for assuring that proper torque is achieved and shall have a torque wrench available for verification by the ENGINEER.

801.9.9 When laying PVC pipe, a metalized detectable warning tape shall be installed a minimum of 1 foot above the top of pipe and 3 to 6 feet below the final surface. The tape shall be detectable with a standard metal pipe locator. The color of tape shall be safety precaution blue and will be inscribed at 10-foot intervals with the words, "CAUTION BURIED WATER LINE BELOW." Tape shall be 2 inches wide. The tape shall be constructed of material that is impervious to alkalis, acids, chemical reagents, and solvents found in the soils.

801.9.10 When laying pipe, Electronic Marker Disks (EMDs) shall be installed in accordance with Section 170.

801.10 SPECIFIC PIPE LAYING REQUIREMENTS

801.10.1 Ductile iron pipe shall be installed in accordance with AWWA C 600 and as herein specified.

801.10.2 Steel pipe shall be installed in accordance with AWWA C 206 for welded joint and as herein specified. All field welded joints shall have one coat of coal-tar enamel of 3/32 inch thickness.

801.10.3 Plastic pressure pipe shall be installed in accordance with AWWA M 23 and C 900 and/or manufacturer's printed recommendations, whichever is applicable. Where a conflict arises with this Specification, this Specification shall control. Trenching, embedment and backfill shall be specified in Section 701. A reference mark (a distinct circumferential line) is placed on the pipes spigot by the manufacturer to indicate the correct depth of the spigot penetration into the pipes gasket joint. If the pipe is seated too deep or too shallow, the pipe may buckle or separate due to thermal expansion/contraction, therefore particular attention must be exercised when jointing pipe. The reference mark must be showing and not farther than 1/2" from the leading edge of the bell. The CONTRACTOR shall verify that the manufacturer's reference mark is correct per manufacturer's literature.

801.10.4 All welded steel and concrete cylinder pipe shall have two small bond wires of low resistance, or other approved method, welded across the joint to make the joint electrically continuous. Where rigid joints are specified they shall be provided as specified herein. The outside joint recess shall be completely filled with a rich low shrinkage cement grout. The concrete surface in contact with the joint mortar shall be moistened with water just prior to pouring the joint recess. The mortar shall be poured into the joint recess against a waterproof paper or cloth diaper laid around and lapping the outside field joint. The diaper shall completely and snugly enclose the joint recess, being held in place by metal box strapping or wire. The mortar shall be poured into an opening slightly to one side on the top of the pipe and rodded by a flexible wire rod into place until it appears on the opposite side completely. After the joint recess has been filled with mortar, adjoining pipe sections shall not be disturbed. After the joint has been made, the concrete lining surfaces of the joint shall be moistened and the interior recess tightly jointed and troweled flush and smooth with the inside pipe surface. Grout for painting the interior joints shall be of a stiff consistency and shall have low shrinkage characteristics. In sizes of pipe smaller than 24", the mortar shall be buttered all around the shoulder inside the bell before the spigot is entered. A backing-up tool, such as an inflated rubber ball wrapped with burlap, shall be pulled through the joint to compact the mortar, completely fill the inside annular space and wipe off the excess mortar. Each joint will be inspected by the ENGINEER for proper and complete closure prior to final acceptance. Flanges shall be protected by "cocoon" type protection coating of coal-tar and felt in accordance with AWWA C 203. When moving individual pipe sections, the pipe shall be lifted using two web or belt type slings which support the pipe between the third and outside quarter points.

801.10.5 All fittings and valves shall be installed as per the type of joint as stated herein and/or as shown on the plans.

801.10.6 All couplings, clamps, sleeves, etc shall be installed as per the manufacturer's printed recommendations and as approved by the ENGINEER. The CONTRACTOR shall properly restrain all appurtenances as necessary.

801.10.7 All waterlines installed as part of a re-use system or other non-potable use shall be purple in color or shall be encased in purple PVC wrap.

801.11 CUTTING: The cutting of any type of pipe shall be done as per the manufacturer's printed recommendations, as approved by the ENGINEER. Care shall be taken in cutting any pipe that has an internal and/or external lining or coating.

801.12 BLOCKING AND RESTRAINED JOINTS

801.12.1 All restrained joints shall be by mechanical means unless directed or approved otherwise by the ENGINEER.

801.12.2 All tees, bends shall be restrained by mechanical means. Valves in runs need not be restrained, except that butterfly valves shall be flanged. Where rigid joints are called for on concrete cylinder pipe, the joints shall be flanged or field welded bell and spigot joints in accordance with the manufacturer's recommendation.

801.12.3 All caps and plugs on dead end lines will be mechanically restrained when feasible. Blocking may also be required when adequate restrain length is not available.

801.12.4 Where restrained joints on ductile iron pipe, or PVC pipe are called for on the plan, the mechanical restraining system employed shall conform to the recommendations of the pipe manufacturer. The restrained joint will be subject to the hydrostatic test specified herein.

801.13 RESTRAINING JOINTS FOR WELDED STEEL AND CONCRETE CYLINDER PIPE

801.13.1 Restrained joints in welded steel and concrete cylinder pipe for thrust restraint shall be produced by continuous welding the pipe joints and as shown on the plans.

801.13.2 Unless otherwise stated in the supplemental specifications the working pressure (operating plus transient) shall be 150 psi. The value for weight of overburden and the coefficient of friction

shall be stated in the supplemental specifications.

801.14 TAPS INTO EXISTING CONCRETE CYLINDER PIPE

801.14.1 OBJECTIVE: The intent of this Subsection is to establish procedural and design criteria for making taps into existing concrete cylinder pipe for water distribution line extensions, and will be applicable to 4-inch and larger size water taps.

801.14.2 NEW WATER LINES: No non-factory taps will be allowed on newly-installed concrete cylinder pipes.

801.14.3 EXISTING WATER LINES:

801.14.3.1 Taps to existing concrete cylinder pipe must be approved in writing by the OWNER. The requester shall provide the following information:

801.14.3.1.1 Justification for the tap,

801.14.3.1.2 Project name and number, if applicable,

801.14.3.1.3 Date tap required,

801.14.3.1.4 Name of the CONTRACTOR who will be making the tap.

801.14.3.2 The CONTRACTOR shall coordinate the work with the OWNER before commencing work. The OWNER shall inspect and approve the entire installation of the tap.

801.14.4 INSTALLATION OF FIELD TAP:

801.14.4.1 Installation of field taps on concrete cylinder pipe shall be no smaller than 4 in. and no larger than 2/3 diameter of pipe to be tapped. No "weld neck" or weld on outlets will be used.

801.14.4.2 For field taps larger than 2/3 of pipe diameter, a tee will be inserted into the line.

801.14.4.3 For field taps greater than 4 in. and less than 2/3 diameter of pipe to be tapped an approved tapping saddle will be used. Tapping saddles shall be approved by the ENGINEER

801.15 SALVAGED MATERIALS

All salvaged materials (pipe, fittings, valves and other water line appurtenances) shall be stockpiled on-site in a neat manner by the CONTRACTOR. The ENGINEER and a representative of OWNER will inspect the stockpiled materials for salvage fitness and direct the following disposition:

801.15.1 If the material is considered salvageable, the CONTRACTOR will be directed to deliver the material to the OWNER. The CONTRACTOR will be responsible for the loading, transportation and off-loading of the salvageable materials. When the materials are delivered, the CONTRACTOR shall obtain a signed receipt from the OWNER. Before final acceptance of the project, all signed receipts will be submitted to the ENGINEER for accounting purposes.

801.15.2 Materials that do not have salvageable value will be disposed of by the CONTRACTOR at no additional cost to the OWNER.

801.16 HYDROSTATIC TESTS:

801.16.1 The CONTRACTOR shall be required to perform hydrostatic tests in all water mains, laterals, dead ends, and service lines in accordance with AWWA C 600. The test shall be conducted in the presence of the ENGINEER or his authorized representative. The testing of the lines shall be done without being connected to existing lines unless approved by the ENGINEER. The CONTRACTOR shall provide all temporary plugs required. If connections to the existing lines are allowed by the ENGINEER, it is with the understanding that the CONTRACTOR assumes any and all responsibility in case of damage or failure of the existing system. Water used for disinfecting may be used for hydrostatic testing. Leakage through connections to the existing system, leaks in the existing lines, or leaking existing valves under the test pressure will invalidate the test. The lines shall be tested at 150 pounds, or 1.5 times the normal working pressure of the line, whichever is greater, for not less than two hours. All taps, gauges and necessary equipment shall be provided by the CONTRACTOR as approved by the ENGINEER, however, the ENGINEER may utilize gauges provided by himself if he so elects. Each section of the new line, between valves shall be tested to demonstrate that each valve will hold the test pressure. No installed pipe will be accepted if the leakage is greater than that determined by hydrostatic test sheet calculations in which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the test pressure in pounds per square inch gauge. During the test the test pressure should not lose more than 10 psig without being pumped back up to test pressure. The totals of the gallons of water required to hold the test pressure during the two hours and the amount of water required to return the line to the test pressure at the end of the test period is the total leakage. If the total leakage is less than the allowable, the line can be accepted. All visible leaks will be repaired regardless of the amount of leakage.

801.16.2 CONTRACTOR shall submit a testing plan to the ENGINEER for approval. In cases where a new main is being connected to an existing main without the installation of a new valve, the end of the new main shall be temporarily capped and blocked and a hydro-static test performed. Hydro-static tests should not be made such that an existing valve or existing main is included in the test section. Test Sheet on page 801-12 is the standard form which must be completed at the time of the test, signed by the ENGINEER and delivered to the OWNER prior to acceptance of the Project

801.17 DISINFECTING, FLUSHING, AND BACTERIA TESTING OF WATER LINES: New water lines shall be installed in such a manner as to not require cleaning by flushing. This shall require capping of stockpiled line, capping of lines at night and any other time work is not in progress, visual inspection of interior of lines, and cleaning as necessary, prior to placing in the trench. Every effort shall be made to prevent the entry of dirt and debris into pipelines under construction.

801.17.1 Mains shall be disinfected in accordance with AWWA C 651 or as required below with chlorine liquid solution, which is added by an approved method at one end of the lines as water is drawn through the lines and service connections. The chlorine solution shall remain in the line for at least 24 hours. The lines shall then be flushed until the chlorine residual is equal to the normal residual in the existing system or at 0.5 parts per million for unchlorinated water. Dry chlorine will not be used for disinfection of water lines. The flushed water will be disposed of by the CONTRACTOR appropriately.

801.17.2. Prior to the line being placed into service, bacteria samples shall be taken by the OWNER. Should results of the bacteriological analysis be unsatisfactory, the disinfection procedure shall be repeated.

801.17.3 The CONTRACTOR will be granted two free volumes of water for testing, disinfecting and flushing the new installation. All water used for testing, disinfecting and flushing shall be metered. If additional water is needed for these purposes, the water will be paid for by the CONTRACTOR at the current water rates. An approved backflow preventor system shall be used when withdrawing water from any waterlines and hydrants. Direct connection to the water system shall not be used for providing water for disinfecting, testing or flushing.

801.17.4 OWNER or the ENGINEER will collect the water sample to test the water in the existing lines at

TEST SHEET 801.16.2
HYDROSTATIC TEST

Test No.: _____

PROJECT NAME: _____
DATE: _____

PROJECT _____ NUMBER: _____
CONTRACTOR: _____

LOCATION: _____

PIPE MATERIAL: _____ DIP _____ PVC _____ CCP _____ Fabricated Steel

Test: Length (S) = _____ ft.
Size (D) = _____ inches
Pressure (P) = _____ psi - gauge (average test pressure during the hydrostatic test)
Leakage Allowed (L_{ALL}) - _____ gal / hr ($L_{ALL} = SD \cdot P / 133,200$ per AWWA C600-99)

Basis: Only resilient seated gate valves and/or rubber seated butterfly valves are used. No metal seated valves are allowed.

Total Leakage Allowed for 2 hour Test Period: $L_{ALL} \cdot 2 \text{ hours} =$ _____ gallons

Actual Amount of Water ADDED to maintain 150 psi \pm 5 psi for 2 hours = _____ gallons

If actual amount of water added is LESS THAN total leakage allowed, test PASSED

If actual amount of water added is GREATER THAN total leakage allowed, test FAILED

_____ Test Passed _____ Test Failed

Contractor _____ Date _____ Inspector _____ Date _____

Project Manager _____ Date _____

COMMENTS:

Note: See Section 801.16 for the Specification for test procedure. A0224B/D2376B
the point of delivery for assurance of clean and

potable water. The water in the existing lines will be used for testing and flushing.

801.18 INTERFERENCE WITH SERVICE AND SCHEDULE OR WORK

801.18.1 The CONTRACTOR shall obtain the permission of the ENGINEER before making any connections with existing mains. The required operation of existing valves will be performed by the OWNER as per Section 18.

801.18.2 Work shall be started after authorization of the ENGINEER and shall be completed in a prompt efficient manner in coordination and cooperation with other utilities concerned. 801.18.3 The CONTRACTOR will be required to arrange his construction program with a view of maintaining continuous service to water users, from existing facilities, to the fullest extent possible. He shall, at all times, withhold construction work, where any conflict in the service requirements occur.

801.19 NOTIFICATION OF COMPLETION

The CONTRACTOR shall notify the ENGINEER, in writing, when the CONTRACTOR has completed construction of a water line. This notification should be submitted immediately upon completion; the water line will not be placed in service by the OWNER before the sewer service and the street are in place and until the OWNER has received and accepted all adequate documentation submittals. OWNER shall consider, on a case by case basis, exceptions for fire protection purposes.

801.20 VALVE CAN REHABILITATION

801.20.1 The rehabilitation of existing valve cans as shown on the plans or as authorized by the ENGINEER shall include the following:

801.20.1.1 Removing the existing valve can and ring and cover and installing the new type can and cover.

801.20.1.2 Install a new concrete collar in paved and unpaved areas. Size and direction of the line should be noted on the collar.

801.20.1.3 The existing ring and cover shall be considered salvaged materials.

801.20.1.4 Removal and replacement of the pavement.

801.20.1.5 Excavation, backfill, and compaction.

801.20.1.6 All materials, labor, and equipment

necessary to do the work.

801.20.2 The work under this item shall be constructed per the Standard Detail Drawings.

801.21 DOCUMENTATION SUBMITTALS

801.21.1 At the time of the final inspection the following documentation will be submitted to the ENGINEER and OWNER:

801.21.1.1 Hydrostatic test data of the new water line system.

801.21.1.2 Microbiological test reports which were taken at representative locations along the system.

801.21.1.3 Fire hydrant and valve cards. All valves at that time shall be in the open position, unless otherwise authorized by the ENGINEER and OWNER.

801.21.1.4 A marked-up set of construction drawings reflecting as-built conditions. This does not supplant the requirements for record or as-built drawings.

801.22 MEASUREMENT AND PAYMENT

801.22.1 PIPE: Payment for all sizes and types of pipe shall be made on the basis of measurement per linear foot, including the length of fittings, valves, etc. The contract unit price of pipe shall include all jointing and coupling materials necessary for its installation and connections to other sections of pipe, except for fittings, valves or other appurtenances. The cost of hydrostatic testing, flushing and disinfecting of new water lines shall be included in the contract unit price for the item in place. Pipe locator tape for pipe shall be included in the contract unit price of the pipe.

801.22.2 DEPTH OF TRENCH:

801.22.2.1 The contract unit price for pipe and appurtenances in all cases shall include the trenching, installation, and compacted backfilling for trench cuts as specified in Section 701.

801.22.2.2 Payment for additional depth, below the specified limits shall be made on the contract unit price per vertical foot per linear foot, and shall include trenching, installation of pipe and appurtenances, and compacted backfilling in the deeper trench.

801.22.3 REMOVAL AND RELAY, RETURN, OR DISPOSAL OF PIPE:

801.22.3.1 The contract unit price for removal and relaying pipe shall include all labor and new gasket material necessary to remove and reinstall pipe in another location.

801.22.3.2 The payment for removing and the delivery 2-1/4 inch to 14 inch pipe to the Water Utility Division in the City Yard as salvage materials shall be made on the unit price per linear foot. Only cast iron or ductile iron pipe that is undamaged will be considered for salvage.

801.22.3.3 Where there is no salvage value of the pipe, the pipe shall be removed and disposed of by the CONTRACTOR. The payment for removal shall be made on a unit price per linear foot; there will be no additional cost to the OWNER for disposal.

801.22.3.4 The payments for removal and relaying, removal and return, or removal and disposal shall include trenching and compacted backfilling.

801.22.4 CAST IRON AND DUCTILE IRON FITTINGS:

801.22.4.1 All cast iron and ductile iron fittings shall be measured and paid for at the contract unit price per pound based on weights of an all mechanical joint ends fitting for the type and size of fitting used as specified in AWWA C 110, regardless of the type of ends on the fitting installed. The contract unit price per pound of fittings shall include all gaskets, glands, bolts and nuts required, no separate payment will be made for these items.

801.22.4.2 When the CONTRACTOR installs a OWNER-furnished fitting and replaces that fitting in the OWNER's inventory, the CONTRACTOR shall be paid the full contract unit price of that fitting as outlined above. If the CONTRACTOR does not replace the fitting in the OWNER's inventory the payment to the CONTRACTOR will be at the contract unit price of the fitting less the cost of the fitting itself.

801.22.4.3 Fitting insertion: The insertion of a fitting into an existing pipe line shall be measured and paid for at the contract unit price per pound based on weights of an all mechanical joint end fitting and if required an all mechanical joint connecting piece (coupling) of the type fitting and size used, as specified in AWWA C 110, regardless of the type of ends on the fitting and coupling installed. This payment shall include all compensation for the excavation, cutting and removal of the existing pipe, installation of the fitting and coupling, if required, the recutting of the existing pipe or new pipe installed between the fitting and coupling, and backfill and compaction complete in place. In addition to the

payment for the fitting insertion, the CONTRACTOR shall be paid for one each non-pressurized (wet) connection and if pavement, curb and gutter, sidewalk, drivepad, etc., are removed, these items will be paid for as part of the appropriate item.

801.22.5 REMOVAL AND RELAY, RETURN OR DISPOSAL OF PIPE APPURTENANCES:

801.22.5.1 The contract unit price for removal and relaying the appurtenances shall include all labor and new gasket material necessary to remove and reinstall the item in another location.

801.22.5.2 The payment for removing and returning 2 1/4 inch to 36 inch appurtenance to the OWNER as salvaged material shall be made on the contract unit price per each or unit price per pound. Only undamaged material will be considered for salvage.

801.22.5.3 Where there is no salvage value of the appurtenance, the item shall be removed and disposed of by the CONTRACTOR. The payment for removal shall be made on the contract unit price per each or contract unit price per pound; there will be no additional cost to the OWNER for disposal.

801.22.5.4 The payment for removal and relaying, removal and return, or removal and disposal shall include trenching and compacted backfilling.

801.22.5.5 Only cast iron or ductile iron appurtenances will be removed and relaid or removed and returned for salvage.

801.22.5.6 Fire hydrant relocation payment shall be the contract unit price per each for removal and reinstallation and shall include excavation, blocking, aggregate and compacted backfilling, as shown in the Standard Detail Drawings.

801.22.6 CONCRETE CYLINDER OR WELDED STEEL PIPE FITTINGS:

Concrete cylinder or welded steel pipe fittings, such as flanged outlets, bends, reducers, etc., shall be considered as incidental to the contract unit price for installation of the pipe, as shown on the construction plans.

801.22.7 COUPLINGS: The measurement for steel or cast iron couplings shall include payment for all gaskets, bolts, and incidental materials as may be needed for its complete installation. Payment shall be made on the contract unit price per each size of coupling required.

801.22.8 STEEL FITTINGS: Steel fittings shall only be used when authorized by the ENGINEER and

when needed to connect to an existing steel water line. Measurement and payment for steel fittings, when authorized, shall be made at the contract unit per pound based on weights of an all mechanical joint ends fitting of the type fitting and size used, as specified in AWWA C 110. This payment shall include all fabrication and welding required on the fitting.

801.22.9 VALVE AND VALVE CANS:

801.22.9.1 Valves shall be measured and paid for at the contract unit price per each size of valve. The contract unit price for valves 24-inch and larger shall include the bypass valve, fittings and piping, complete in place.

801.22.9.2 Valve boxes shall be measured and paid for at the contract unit price per each per type of valve boxes, which payment shall include the concrete pad with stem extension when required, complete in place.

801.22.10 FIRE HYDRANTS: Fire hydrants shall be measured and paid for at the contract unit price per each per depth of bury, which payment shall include excavation, gravel drain pocket, mechanical restraining system or blocking, backfilling, and compaction complete in place.

801.22.11 VALVE BOX ADJUSTMENTS:

801.22.11.1 Valve box adjustment using the adjustment collar and insert shall be measured and paid for per each complete in place including the concrete pad.

801.22.11.2 When the adjustment height required on a valve box exceeds the height of the adjustment collar or the valve box has been previously adjusted, the valve box will have to be rehabilitated. Measurement and payment shall be made as specified under Valve Box Rehabilitation.

801.22.12 WATER LINE CONNECTIONS:

801.22.12.1 Nonpressurized Connections: Nonpressurized connections shall be measured and paid for at the contract unit price per each for any size or type of pipe, complete in place, which shall include any extra excavation required, shut-off coordination, the removal of any caps or plugs or the cutting of the existing pipe any number of times required to make the connection, drainage plan (if required), pumping or handling of the water, backfilling and compaction. Fittings shall be measured and paid for per pound as specified herein, including all types of couplings.

801.22.12.2 Pressurized Connection: Pressurized connections shall be measured and paid for at the contract unit price per each per location shown on the plans, complete in place, which shall include excavation, the cleaning or removal of existing pipe coatings and coverings, air testing, the tapping, any grouting required, backfilling and compaction. The installation of the tapping sleeve and gate valve is to be paid under separate item or as indicated on the plans.

801.22.12.3 Connection to Steel Water Lines: All connections to existing steel water lines shall be made by using a transition coupling. The measurement and payment for this type of connection shall be made per pound of fitting for a Mechanical-Joint Connecting Piece of the size used based on the weights specified in AWWA C 110.

801.22.13 THRUST RESTRAINTS:

801.22.13.1 CONCRETE BLOCKING: When concrete blocking is used as a substitute for a mechanically restrained joint as authorized by the ENGINEER, the blocking shall be measured and paid for at the contract unit price per cubic yard placed to the neat lines shown on the plans or per the Standard Detail Drawings.

801.22.13.2 RESTRAINING JOINTS FOR WELDED STEEL OR CONCRETE CYLINDER PIPE: Measurement and payment for this item shall be at the contract unit price per linear inch of circumferential weld, complete in place, including protective coating of the weld.

801.22.13.3 MECHANICALLY RESTRAINED JOINTS: Mechanically restrained joint assemblies shall be measured and paid for at the contract unit price per each assembly per size of the pipe per each type (pipe to pipe, pipe to mechanical joint, pipe to fitting, etc.) complete in place.

801.22.13.4 VALVE ANCHORAGE: No separate measurement nor payment shall be made for valve anchorage as per Standard Detail Drawing. The cost of this work shall be included with the cost of the valve.

801.22.14 PRESSURE REDUCING VALVE (PRV): Measurement and payment for furnishing and installing a PRV shall be made at the contract unit price per each per size, complete in place as shown on the plans or in the Standard Detail Drawings. The payment shall include all labor, equipment and material required for the excavation, the PRV, all bypass piping, fittings and valves both inside and outside the structure, the structure, backfilling and compaction.

801.22.15 AIR RELEASE VALVE (ARV): Measurement and payment for furnishing and installing an ARV shall be made at the contract unit price per each per size of ARV, complete in place as shown on the plans or in the Standard Detail Drawings. The payment shall include all labor, equipment and materials required for the excavation, ARV, piping, fittings, gate valve, can or structure, backfilling, and compaction.

801.22.16 VALVE BOX REHABILITATION: Valve box rehabilitation shall be measured and paid for at the contract unit price per each, complete in place which shall include the removal of the existing valve box, excavation, the new valve box installed, backfilling, compaction and the installation of the concrete collar.

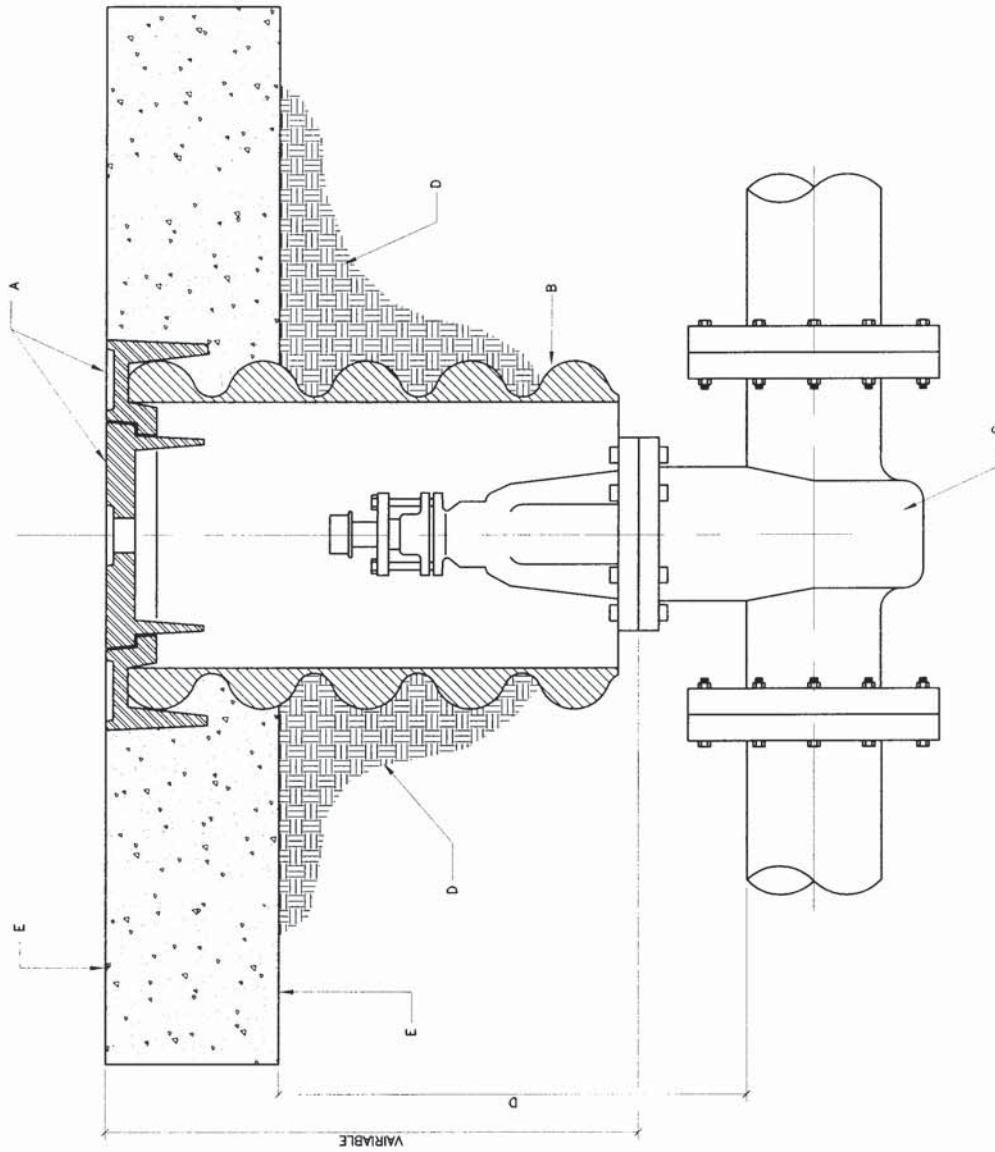
801.22.17 CONCRETE STRUCTURES: The removal and replacement of concrete structures such as sidewalks, drive pads, and curb and gutters etc., required for the installation of water lines shall be measured and paid for as specified in Section 340 and 343.

801.22.18 BEDDING MATERIAL: No separate measurement nor payment shall be made for bedding material required when shown on the plans or when required due to the type of pipe supplied by the CONTRACTOR. The cost of the bedding material shall be included in the unit price of the pipe. If bedding material is not required by the conditions above but is required due to the conditions encountered during construction then the bedding material shall be measured and paid for as specified in Section 701.

801.22.19 SURPLUS MATERIALS: No separate measure nor payment will be made for the removal and disposal of surplus material generated by the pipe, bedding material or the use of lean fill.

GENERAL NOTES:

- A VALVE BOX RING AND COVER PER STD. DWG. 2328.
- B 10" DIAMETER RIBBED OR CORRUGATED PVC OR PE PIPE WITH SMOOTH INTERIOR (C-900).
- C NEW OR EXISTING VALVE.
- D COMPACTED BACKFILL SOIL OR BASE COURSE MATERIAL (95% COMPACTION). SEE SECTION 701.
- E CONCRETE COLLAR PER STD. DWG. 2461.
- F TOP OF CONCRETE COLLAR SHALL BE STAMPED WITH LINE SIZE AND DIRECTION. MINIMUM LETTER SIZE SHALL BE 3" IN HEIGHT.
- G MIN. 6" OR MATCH EXISTING.



LINE SIZE, SEE NOTE F

LINE DIRECTION, SEE NOTE F

LABEL REQUIREMENTS

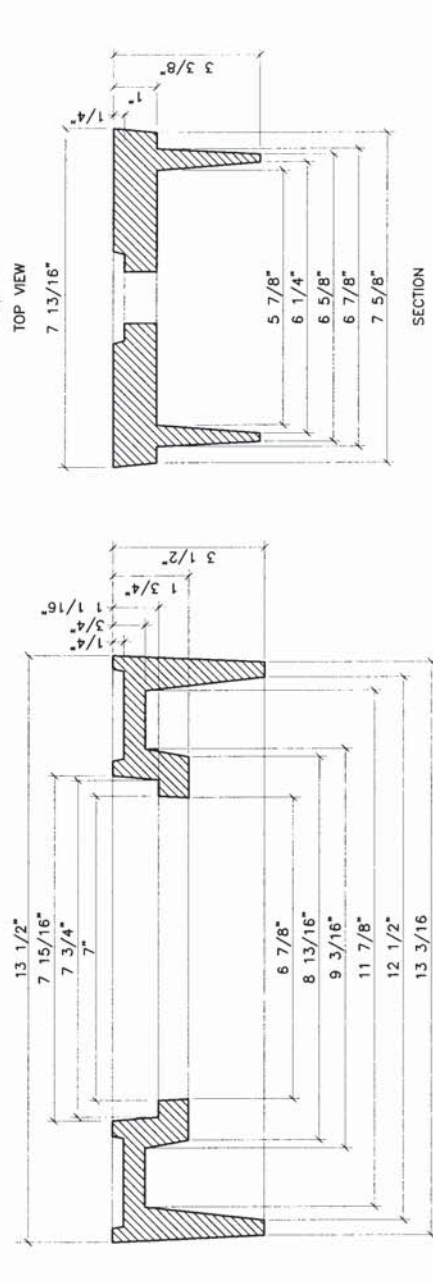
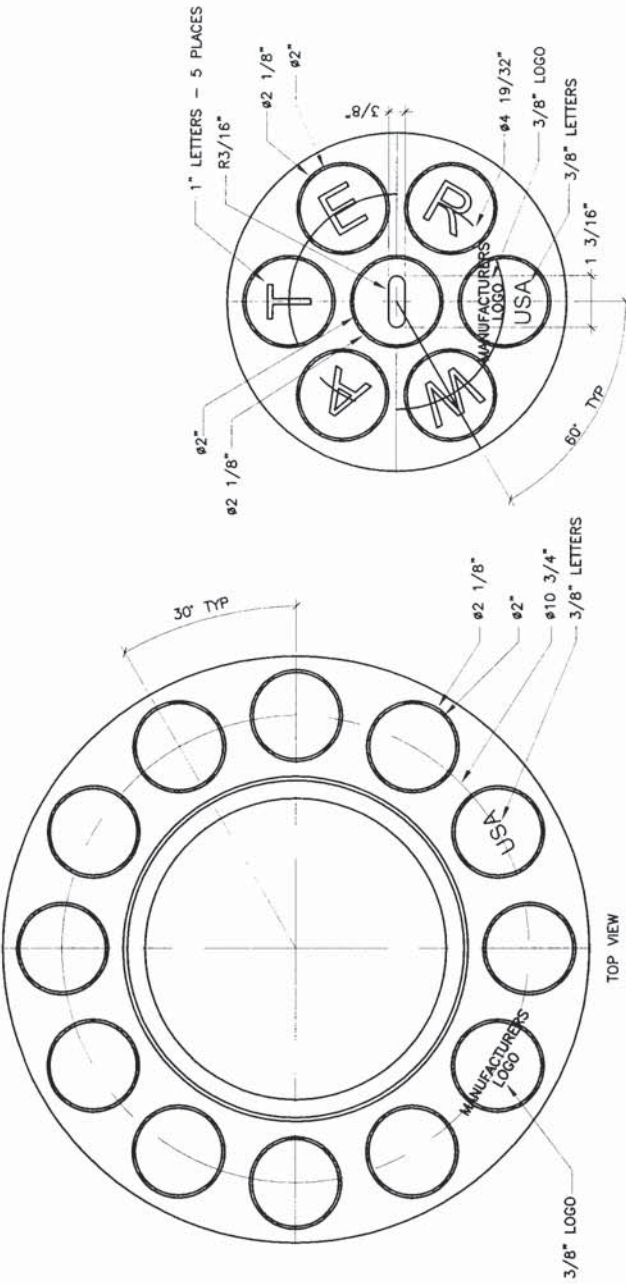
REVISIONS	NM APWA
	WATER VALVE BOX
DWG. 2326	FEB. 2006

GENERAL NOTES — RING

- 1 VALVE BOX RING DESIGNED TO ACCEPT VALVE BOX COVER.
- 2 THE CASTING NUMBER, MANUFACTURER'S LOGO, DATE OF MANUFACTURE AND "USA" SHALL BE CAST IN A CONSPICUOUS LOCATION ON BOTH THE RING AND THE COVER.
- 3 FILLETS SHALL BE 1/4"R UNLESS OTHERWISE SPECIFIED.
- 4 A DRAFT ANGLE OF 3°-5° SHALL BE APPLIED UNLESS OTHERWISE SPECIFIED.
- 5 FINISH: REMOVE EXCESS IRON AND FINIS.
- 6 THIS DETAIL DOES NOT APPLY FOR VALVE BOX RING AND COVER TO BE USED ON REUSE OR NON-POTABLE WATER SYSTEMS.

GENERAL NOTES — COVER

- 1 VALVE BOX COVER DESIGNED TO FIT INTO VALVE BOX RING.
- 2 THE CASTING NUMBER, MANUFACTURER'S LOGO, DATE OF MANUFACTURE AND "USA" SHALL BE CAST IN A CONSPICUOUS LOCATION ON BOTH THE RING AND THE COVER.
- 3 FILLETS SHALL BE 1/4"R UNLESS OTHERWISE SPECIFIED.
- 4 A DRAFT ANGLE OF 3°-5° SHALL BE APPLIED UNLESS OTHERWISE SPECIFIED.
- 5 FINISH: REMOVE EXCESS IRON AND FINIS.



SECTION
VALVE_BOX_COVER

SECTION
VALVE_BOX_RING

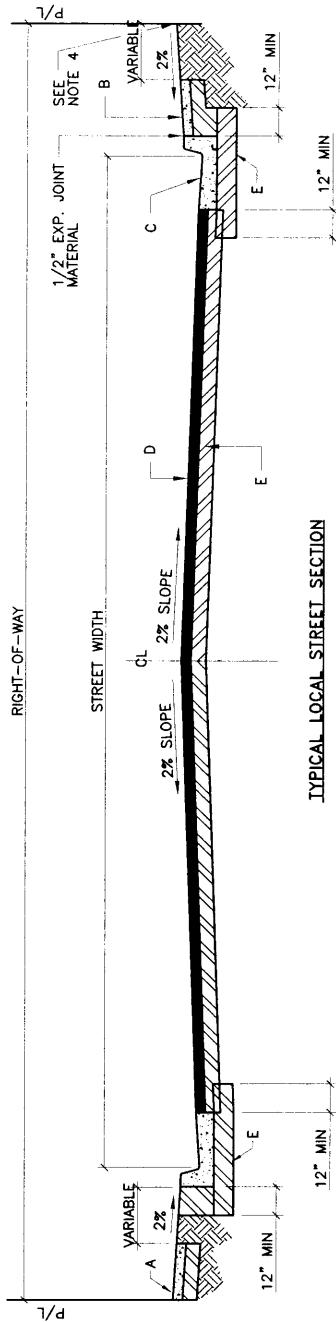
REVISIONS	NM APWA
	WATER RING AND COVER FOR VALVE BOX
	DWG. 2328 FEB. 2006

GENERAL NOTES:

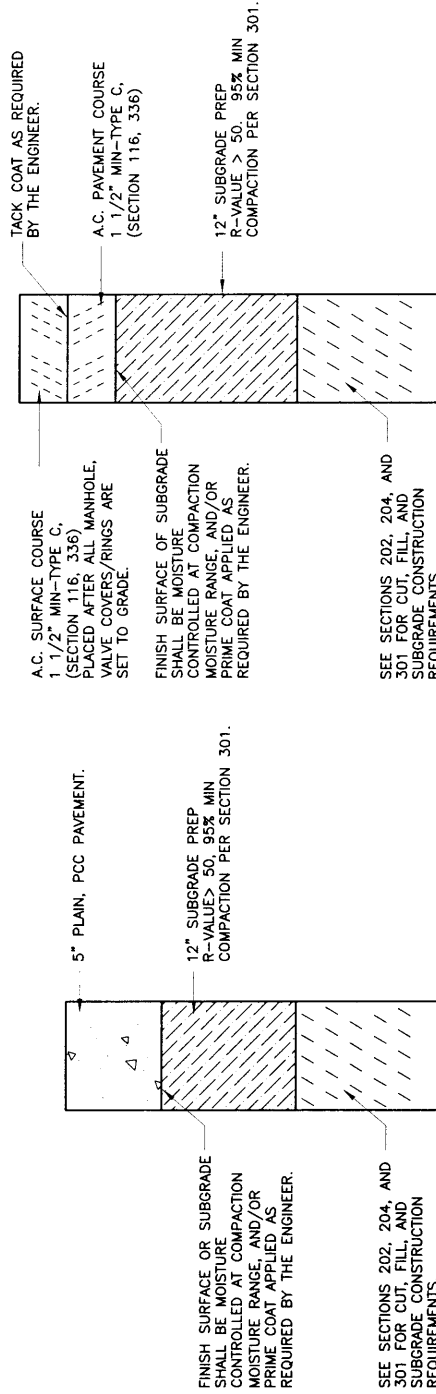
1. CROWN ON STREET SHALL BE AS FOLLOWS:
 - a. 32' STREET = 4"
 - b. 40' STREET = 5"
 - c. LESS THAN 32' STREET, PAVEMENT SLOPE = 2%
2. ALL SUBGRADE COMPACTION FOR C & G SHALL EXTEND 12" MIN ON EITHER SIDE OF C & G OR CURB SECTION.
3. SUBGRADE PREPARATION UNDER SIDEWALK AND DRIVE PADS SHALL BE INCIDENTAL TO ITEM.
4. FINISH GRADE AT PROPERTY LINE SHALL BE BASED ON A MIN 2% SLOPE FROM TOP OF CURB.
5. ALL ASPHALT CONCRETE (AC) PAVEMENT SHALL COMPLY WITH SECTION 116.
6. ALL PORTLAND CEMENT CONCRETE (PCC) PAVEMENT SHALL COMPLY WITH SECTION 101.
7. THE FOLLOWING APPLIES UNLESS AUTHORIZED OTHERWISE BY THE ENGINEER:
 - * RESIDENTIAL STREETS SERVING 50 LOTS OR LESS SHALL BE DESIGNED AS LOCAL RESIDENTIAL STREETS.
 - * RESIDENTIAL STREETS SERVING MORE THAN 50 LOTS WITH AN ANTICIPATED AWDT < 3000 SHALL BE DESIGNED AS MAJOR LOCAL STREETS.
8. FOR SUBGRADE R-VALUE < 50, PAVEMENT SECTION SHALL BE DESIGNED BY ENGINEER
9. SUBGRADE PREPARATION SHALL BE PERFORMED AFTER ALL SUBSURFACE UTILITIES ARE CONSTRUCTED.

CONSTRUCTION NOTES:

- A. SIDEWALK AT STANDARD SETBACK.
- B. SIDEWALK ADJACENT TO CURB. (NON-STANDARD, VARIANCE REQUIRED).
- C. STANDARD CURB AND GUTTER.
- D. ASPHALT CONCRETE (AC) OR PORTLAND CEMENT (PCC) PAVEMENT.
- E. 12" COMPACTED SUBGRADE PREP, 95% COMPACTION.



TYPICAL LOCAL STREET SECTION



RIGID PAVEMENT SECTION

FLEXIBLE PAVEMENT SECTION

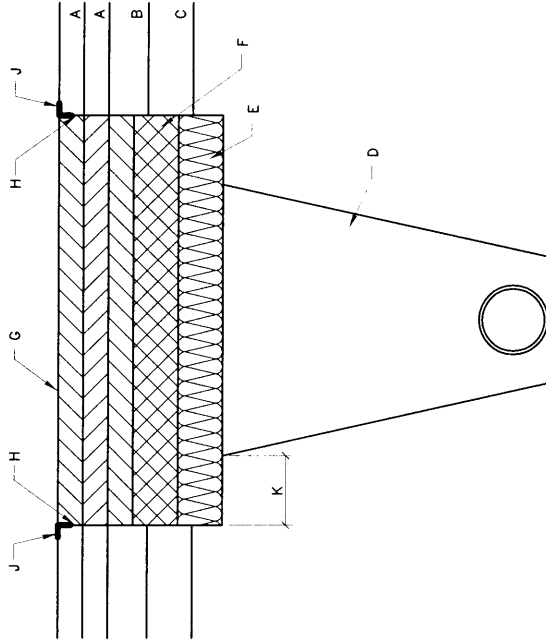
REVISIONS	NM APWA
1/91	PAVING
12/15/92	LOCAL - RESIDENTIAL
8/29/94	STREET SECTION
	DWG. 2405A FEB. 2006

GENERAL NOTES:

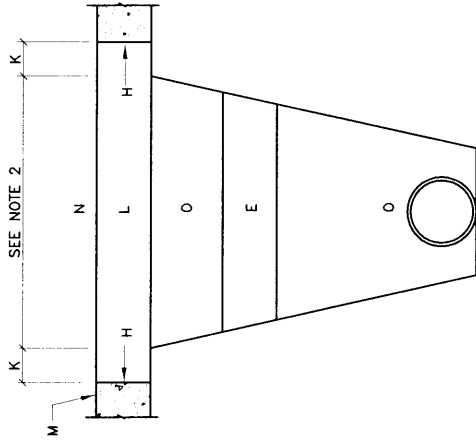
1. COMPACTION AS DETERMINED BY ASTM D1557 MAX DENSITY.
2. TRENCH CUT WIDTHS SHALL BE MIN. WIDTH REQ'D. FOR UTILITY INSTALLATION, ECONOMICAL BACKFILL COMPACTION AND COMPLIANCE WITH CURRENT AND APPLICABLE SAFETY REGULATIONS.
3. ALL PAVEMENTS CUT EDGES WILL BE TRIMMED TO PRESENT AN EVEN LINE PRIOR TO REPLACEMENT OF PAVING MATERIAL.
4. "STITCH" CUTTING OF PAVEMENT WILL NOT BE PERMITTED. ADDITIONAL 2" THICKNESS OF ASPHALT CONC. REQ'D ON PAVEMENT CUTS 8' OR MORE IN WIDTH AND LONGER THAN 100' SHALL BE PLACED WITH LAYDOWN MACHINE TO A DEPTH EQUAL TO THAT OF ASPHALT CONC. REMOVED.

CONSTRUCTION NOTES:

- A. EXISTING ASPHALT PAVEMENT.
- B. EXISTING BASE MATERIAL (ABC, BTB, CTB)
- C. EXISTING SUBGRADE
- D. COMPACTED FILL - 95% COMPACTION
- E. SUBGRADE TO MEET OR EXCEED APPARENT R-VALUE OF ADJACENT SOIL BY SOIL CLASSIFICATION (2 FEET MIN.).
- F. MATCH EXISTING BASE MATERIAL PLUS AN ADDITIONAL 2" OF THICKNESS - 95% COMPACTION
- G. MATCH EXISTING ASPHALT CONCRETE SECTION PLUS AN ADDITIONAL 2" OF THICKNESS
 - a) FOR RESIDENTIAL STREETS, SURFACE COURSE SHALL BE 1 1/2" THICK, TYPE C
 - b) FOR MAJOR LOCAL STREETS, SURFACE COURSE SHALL BE 2" THICK, TYPE B
 - c) FOR ALL OTHER STREETS, SURFACE COURSE SHALL BE 2" THICK, S-III
- H. SAW CUT OR BLADE-CUT ASPHALT PAVEMENT. SAW CUT ONLY ONE THIRD CONC. DEPTH
- J. TACK COAT
- K. 12" CUT-BACK
- L. MATCH EXISTING CONCRETE PAVEMENT THICKNESS, 6" MINIMUM, 4000 PSI
- M. EXISTING CONCRETE PAVEMENT
- N. JOINTS TO BE TOOLED & SEALED IN ACCORDANCE WITH ENGINEERS REQUIREMENTS
- O. 6" CONC. TREATED BASE (C1.B).



ASPHALT CONCRETE PAVEMENT



CONCRETE PAVEMENT

REVISIONS	NM APWA
1/91	PAVING
12/15/92	CITYWIDE PAVEMENT CUTS FOR ALL UTILITIES
DWG. 2465	FEB. 2006