PART "T"

TECHNICAL SPECIFICATIONS

City of Dallas

ISSUED FOR BID

SPECIFICATIONS

AND

FORMS OF CONTRACT AND BONDS

FOR

AIR VALVE IMPROVEMENTS FOR 84-INCH WHITE ROCK NORTH TRANSMISSION MAIN

CONTRACT NO. 20 - 001/002

MAY 2020

dallas water utilities
city of dallas

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SECTION 01 29 10 – CONSTRUCTION AND OPERATIONS COORDINATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Incorporate and implement requirements for coordinating with Owner's operations during the Work, and adhere to requirements for shutdowns and sequencing necessary to complete the Work without impact on Owner's pumping operations except as planned.
2. Provide labor, materials, tools, equipment, spare parts, and incidentals both temporary and permanent necessary to successfully complete the Work.

B. Coordination:

1. Review shutdown schedule to be provided by Owner and coordinate Work that must be performed before or during the shutdown with the Work specified in this Section.

C. Work shall be planned, scheduled, coordinated, and performed to prevent any delay to the completion of the Project within the time limits stated in the Contract. The Contractor shall adhere to the approved Construction Schedule and the shutdown sequencing specified herein.

D. Except for shutdowns specified in this Section, perform the Work such that Owner's pumping operations remain continuous during the Work. Schedule and conduct the Work such that the Work does not impede Owner's pumping operations, reduce the quality of the water being transmitted, or cause any hazardous condition in any of the installation sites.

E. Work not specifically covered in this Section, but necessary for the Work, is considered subsidiary, and Contractor shall plan for such Work.

F. Coordinate shutdowns with Owner and Owner's Representative. When possible, combine multiple installations into a single shutdown to minimize impacts on Owner's operations and processes. Plan for and perform preparatory work prior to shut down, such as excavation, trenching, shoring, dewatering, exposing buried pipe, installing tapping sleeve, traffic control and staging equipment and material at Work site.

G. Contractor may utilize multiple crews to minimize shutdown frequency and duration to minimize impacts on Owner's pumping operations and processes, provided that Work is fully coordinated with Owner's Representative.

H. Operations of distribution pumps (for transmission or filling pipelines), inline isolation valves and blowoff valves (for shutting down or opening pipeline segments)will be by Owner's personnel unless otherwise specified or indicated. Dewatering of pipes and associated water management is the responsibility of the Contractor.

1.2 SUBMITTALS

A. Action Submittals: Proposed Sequence of Construction Submittal:

1. Provide submittal detailing the proposed sequence of construction. Provide submittal prior to submitting the Project Baseline Schedule. Identify each installation during a shutdown in the submittal, and include estimated duration of each shutdown including:

a. A table showing that each installation can be completed within the shutdown period scheduled by Owner.
b. If the Contractor's proposed construction sequence varies from that contained in this specification section, Contractor shall:

1) Explain the variation within the submittal and confirm the Owner's operations will not be adversely affected by proposed change.
2) List benefits of proposed sequence change, including benefits to project's schedule.

B. Informational Submittals: Submit the following:

1. Draft Proposed Sequence of Construction

a. Contractor shall provide a Draft Proposed Sequence of Construction Submittal for informational purposes one week prior to holding the Proposed Sequence of Construction Workshop. The submittal shall also precede the Project Baseline Schedule.

2. Shutdown Planning Submittals:

a. For each shutdown, submit an estimate of time required to accomplish the complete shutdown, including dewatering, installation of air valve, refilling and disinfection. Include equipment/ material in staging areas, and written description of steps required to complete the Work associated with the shutdown. Include the air valve installations to be completed during each shutdown and a detailed description and schedule for each air valve installation associated with the shutdown.
b. Furnish submittal to Engineer at least 30 days prior to proposed shutdown start date, and after the shutdown planning meeting. Do not start shutdown until obtaining Engineer's acceptance of shutdown planning submittal.
c. Furnish activity hazard analysis and safety procedures required to perform the shutdown and installation tasks.

3. Shutdown Notification: After acceptance of shutdown planning submittal and prior to starting the shutdown, provide written notification to Owner, Owner's Representative, and Engineer of date and time each shutdown is to start. Provide notification at least two weeks in advance of each shutdown.
4. Emergency Response Plan: Develop Emergency Response Plan detailing steps to be followed if Work is to be terminated urgently for the following reasons:
a. to resume pumping upon notification by Owner.

b. When pipe tapping cannot be completed for any reason.

5. Detail all emergency response operations, communication, equipment and supplies, personnel, approximate time to restore service, and emergency procedures to be followed to restore the transmission pipeline to be ready for pumping.

1.3 WORKSHOPS

A. Proposed Sequence of Construction Workshop

1. Within three weeks after the Pre-Construction Meeting, Contractor, Engineer, Owner, and Owner's Representative shall hold a workshop meeting to discuss the Contractor's proposed sequence of construction. Each installation during a shutdown shall be identified during this workshop, as well as the estimated duration of each shutdown. The Draft Proposed Sequence of Construction submittal will be used to guide discussion during this workshop.

B. Preparatory Shutdown Workshops

1. Prior to providing shutdown planning submittals, Contractor, Engineer, Owner, and Owner's Representative shall hold a workshop meeting to discuss the upcoming shutdown. Each installation during a shutdown shall be identified during this workshop, as well as the estimated duration of the shutdown. Shutdown Planning Submittals will be used to guide discussion during these workshops.

1.4 GENERAL CONSTRAINTS

A. Contractor shall work within the specified shutdown durations in the shutdown schedule provided by Owner. Sequencing can be modified to fit the work items within the given duration. Contractor shall take into the shutdown schedule the duration for equipment, materials, and systems successfully completed acceptance testing.

B. The following provisions apply to coordination with Owner's operations:

1. At new air valve locations specified for pipe segment replacement, dewatering of a portion of the pipeline will be required to eliminate all water within the construction area. Owner will assist Contractor in determining the extent of the dewatering required to suitably remove water from the proposed excavation area.
2. At existing air valve locations where new isolation gate valves are required, dewatering of a portion of the pipeline will be required to lower the static water level below the pipe crown. Owner will assist Contractor in determining the extent of the dewatering required to lower static water level below pipe crown.
3. All locations specifying air valve installation by tapping methods will be completed under low-pressure conditions (not considered a "hot" tap). At these new air valve locations, dewatering of a portion of the pipeline will be required to lower the static water level below the pipe crown. Owner will assist Contractor in determining the extent of the dewatering

required to suitably lower the water pressure in the construction area to such that the static water level remains below the pipe crown.

4. Dewatering of pipe segments will be between existing in-line isolation valves. As such, Contractor should anticipate extent of dewatering required for pipelines lengths between these isolation valves.
5. Contractor's dewatering pumps will connect to an existing blow-off valve within the isolated segment to be dewatered.
6. Owner will assist Contractor in dewatering pipelines in installation locations where pipe joint replacement method is called out in the Contract Documents or as directed by the Owner's Representative. Maintain clean and dry work area by pumping and properly disposing of fluid that accumulates in work areas.
7. Contractor shall remove water and dispose of it at the closest sanitary sewer manhole to the Work site as directed by Owner's Representative. Contractor shall provide and utilize hoses, piping, pumps, and other equipment necessary to completely dewater pipelines segments to be removed. Discharge into sewers shall be at a rate so as not to result in sanitary sewer overflows. Discharge of fluids on surface is not allowed and Contractor is responsible for all associated costs for any spillage.
8. Uncontrolled spillage of contents of pipes or conduits is not allowed.

1.5 SEQUENCE OF WORK

A. The Contractor shall plan, schedule, and coordinate his work such that the air valve installations within each scheduled shutdown can be completed within the allowable shutdown duration. If work cannot be completed within the shutdown period, Contractor shall inform Owner's Representative, and all work shall be stopped, and pipe returned to working condition. The Contractor shall request extension of the shutdown period in writing to the Owner in advance detailing reasons why work cannot be completed within the allotted time. Contractor shall receive written approval if granted. If shutdown cannot be extended, Contractor shall re-schedule Work to be completed with the next scheduled shutdown.

B. Shutdown Table at the end of this section lists shutdowns and air valve installations associated with each as planned. Actual timing of shutdowns and durations will be provided by Owner Pumping Division at the beginning of construction.

C. The Contractor's sequence of work may vary from the general sequence of work presented herein as long as it meets the intent and is within the constraints presented herein.

D. The general sequence of work described below includes the major phases of Work and may not include all elements of Work. Contractor shall plan for all Work.

1. In locations where new valves are to be installed, Contractor shall, with the help of Owner's Representative, verify transmission line location by pot-holing.
2. Owner's Representative shall indicate the closest isolation valves locations at each installation site that will be used to isolate individual pipe segments. Condition assessment and operation of the valves shall be by Owner staff only except as directed the Owner's Representative.
3. Owner's schedule for pump stations shutdown shall be provided to the Contractor.

4. Contractor shall coordinate with and notify Owner to confirm work items and shutdown schedule.
5. All materials and labor necessary for construction shall be on site prior to commencing the work.
6. Excavate trench and install trench safety system. No stockpile of spoils shall be allowed in paved areas. Use haul trucks to store stockpile.
7. Contractor shall drain transmission main. Provide all labor, material, and equipment necessary.

    a. Owner staff shall locate blow off valves and indicate locations. Operation of blowoff valves shall be by Owner staff only.
    b. Contractor shall pump water from pipe to closest drainage inlet or sanitary sewer manholes as directed by Owner staff. Coordination with Public Works and Wastewater Collections departments.

8. For pipe joint replacement method, cut pipe, remove, and dispose of segments appropriately in accordance with laws, regulations, and as directed by Owner.

    a. Install new pipe joint(s) with integral outlet at locations with pipe joint replacement or perform tapping for locations called out for pipe tapping.
    b. Perform pipe flushing on new pipe joints. Coordinate with Owner Distribution Department for location of water source and disposal of flushing water. Contractor shall install a meter and pay for flushing water.

9. Disinfection and testing:

    a. Chlorination/ Decholorination: Provide testing and chlorination fittings, other material, equipment, and incidentals to perform disinfection. Once all pipe work is completed to the satisfaction of the Owner's Representative, Dallas Water Utilities shall perform, as required, chlorine disinfection, sampling and analysis.
    b. Dispose of water to drainage inlet or sanitary sewer manholes (coordination with Public Works and Wastewater Collections)

10. Bacteriological Test: Owner will perform sampling and analysis.
11. Backfill excavation area and restore site to pre-construction condition. In paved areas, overlay new pavement per Dallas Public Works Pavement Restoration requirements and specifications.

1.6 PIPELINE DEWATERING

A. Provide equipment, labor, material, and incidentals in a complete system to dewater pipelines and lower pressure in order to permit construction activities. Install sufficient dewatering equipment to drain pipeline segments isolated for construction.

B. Operate dewatering system continuously until dewatering is no longer required upon reaching the desired pressure in the pipeline. Coordinate pressure readings with Owner's representative.

C. Dispose of water removed from pipeline in a manner to avoid endangering public health, property, and portions of work under construction or completed. Coordinate water disposal to the closest sanitary sewer as directed by the Owner's representative.

D. Remove the dewatering system when no longer required.

1.7 SHUTDOWNS

A. Shutdowns of Owner's facilities will be required to perform Work. These facilities will include the Jim Miller Pump Station, the Elm Fork Pump Station, East Side Water Treatment Plant, and the Elm Fork Water Treatment Plant; shutdowns may also be required at other facilities.

B. Shutdowns will be in accordance with limitations outlined in Table 01 29 10-A of this Section and all other provisions included herein.

C. Annual Pump Station and Plant Maintenance Shutdowns:

1. As part of the normal operation, the Owner shuts down their facilities for a predetermined period to perform maintenance on areas that cannot typically be worked on when the facility is in operation.
2. Annual Plant Maintenance Shutdown duration will be determined by Owner Pumping and Distribution divisions, and Contractor shall be informed of the durations and calendar schedule in advance for planning purposes.
3. Annual Pump Station Maintenance Shutdown window: typically, during low flow demands in the winter months

    a. Owner performs Annual Maintenance Shutdown at their discretion.
    b. Contractor to coordinate with Owner on timing and duration of Annual Maintenance Shutdown for affected Plants.

D. Low Flow Demand Period Shutdowns

1. Shutdowns for the Work will only be allowed during low flow demand period, which spans from October to March.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULES

A. The schedule listed below, following the "End of Section", is part of this Specification section and details proposed shutdown for the Work.

1. Table 01 29 10-A Shutdown Schedule

3.2 STAKEHOLDERS COORDINATION

A. Coordinate with stakeholders for each installation location and abide by notification, restoration requirements, and procedures set by the various entities. A list of stakeholders for each installation location is included in:

1. Table 01 29 10-B Stakeholders List

END OF SECTION 01 29 10

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Table 01 29 10-A Shutdown Schedule

Shutdown No.	DWG. No.	Transmission Main and Size	ARV Numbers	Maximum Duration of Shutdown	Procedure	Constraints and Remarks
1	685W 549 Sh 01 685W 660 Sh 11	WRNTM – 90" WRNTM – 84"	2.0.E (STA 006+83) 3.1.E (STA 113+04)	TBD	1. Shutdown JMPS (Required for all Work in Shutdown No. 1). 2. Close 72" BFV (STA 0+07.5). INV EL = 508.48, TOP EL = 514 3. Drain with 12" Blowoff Valve located in MH-3 (STA 4+83.56). INV EL = 500.92, TOP EL = 508 4. Replace Existing Air Release Valve (STA 006+83). INV EL = 512, TOP = 519 5. Replace Existing Air Release Valve (STA 113+04). INV EL 476, TOP = 483	1. Work to be performed during Low Flow Production Period. 2. Elm Fork Pump Station on-line and supplies Doran, Abrams, Walcrest branches, and Beltwood Reservoir.
	685W 660 Sh 14 685W 660 Sh 15 685W 660 Sh 16 685W 660 Sh 17 685W 660 Sh 18 685W 660 Sh 19		4.2.E (STA 143+95) 5.2.E (STA 162+50) 6.2.N (STA 174+00) 7.2.E (STA 184+60) 8.2.E (STA 194+40) 9.2.E (STA 208+60)		1. Close 84" BFV (STA 123+20). INV EL = 457, TOP EL = 464 2. Close in-line 84" BFV (STA 252+70). INV EL = 445, TOP EL = 452 3. Drain with in-line Blowoff Valve (STA 132+95). INV EL = 443, TOP EL = 450 4. Drain with Blowoff Valve (STA 149+04). INV EL = 445, TOP EL = 452 5. Drain with Blowoff Valve (STA 187+15). INV EL = 495, TOP EL = 502 6. Drain with Blowoff Valve (STA 200+80). INV EL = 480, TOP EL = 488 7. Replace Existing Air Release Valve (STA 143+95). INV EL = 473, TOP EL = 480 8. Replace Existing Air Release Valve (STA 162+50). INV EL = 492, TOP EL = 499 9. Install New Air Release Valve (STA 174+00). INV EL = 501, TOP EL = 508 10. Replace Existing Air Release Valve (STA 184+60). INV EL = 505, TOP EL = 512 11. Replace Existing Air Release Valve (STA 194+40). INV EL = 505, TOP EL = 512 12. Replace Existing Air Release Valve (STA 208+60). INV EL = 511, TOP EL = 518	
2	685W 660A Sh 26 685W 660B Sh 12 685W 660B Sh 12 685W 660B Sh 14 685W 660C Sh 04	WRNTM – 84"	10.6.E (STA 042+41) 11.8.N (STA 140+00) 12.8.N (STA 150+00) 13.8.E (STA 167+00) 14.10.E (STA 033+90)	TBD	1. Close 84" BFV (STA 517+60). INV EL = 492, TOP EL = 499 2. Close 84" BFV (STA 41+41). INV EL = 599, TOP EL = 606 3. Drain with Blowoff Valve (STA 74+10). INV EL = 497.5, TOP EL = 504.5 4. Replace Existing Valve (STA 042+41). INV EL = 543.5, TOP EL = 550.5 5. Install New Air Release Valve (STA 140+00). INV EL = 587, TOP EL = 594 6. Install New Air Release Valve (STA 150+00). INV EL = 606.5, TOP EL = 613.5 7. Replace Existing Valve (STA 167+00). INV EL = 621, TOP EL = 629 8. Replace Existing Valve (STA 033+90). INV EL = 615, TOP EL = 622	1. Work to be performed during Low Flow Production Period. 2. Jim Miller Pump Station on-line, supplies Doran, Abrams, Walcrest branches 3. Elm Fork Pump Station supplies Beltwood Reservoir.
3	685W 660 Sh 37 685W 660 Sh 37	Doran Branch – 54"	D.1.N (STA 027+50) D.2.E (STA 032+19)	TBD	1. Close 48" BFV Valve (STA 0+00). INV EL = 447.5, TOP EL = 452 2. Close 54" BFV (STA 32+59). INV EL = 534, TOP EL = 538.5 3. Drain with Blowoff Valve (STA 10+90). INV EL = 449.5, TOP EL = 454 4. Install New Air Release Valve (STA 027+50). INV EL = 522.5, TOP EL = 527 5. Replace Existing Air Release Valve (STA 032+19). INV EL = 532.5, TOP EL = 537	1. Work to be performed during Low Flow Production Period. 2. Jim Miller Pump Station on-line, supplies Abrams, Walcrest branches, Beltwood Reservoir. 3. Jim Miller Pump Station back-feeds Doran from East High.
4	685W 660D Sh 02 685W 660D Sh 04 685W 660D Sh 05 685W 660D Sh 08 685W 660D Sh 08	Abrams Branch – 54"	A.1.E (STA 020+75) A.2.N (STA 040+50) A.3.E (STA 049+00) A.4.N (STA 086+00) A.5.N (STA 095+50)	TBD	1. Close 24" Gate Valve interconnecting Abrams Branch to Section 04 (STA 0+12) INV EL = 475, TOP EL = 479.5. 2. Close 54" Butterfly Valve (STA 0+31). INV EL = 464, TOP EL = 468.5 3. Close in-line 54" Butterfly Valve (STA 101+09.50). INV EL = 610, TOP EL = 614.5 4. Drain with Blowoff Valve (STA 6+10). INV EL = 463, TOP EL = 467.5 5. Drain with Blowoff Valve (STA 31+40). INV EL = 533.5, TOP EL = 538 6. Drain with Blowoff Valve (STA 68+40). INV EL = 552, TOP EL = 556.5 7. Replace Existing Air Release Valve (STA 020+75). INV EL = 550, TOP EL = 554.5 8. Install New Air Release Valve (STA 040+50). INV EL = 580, TOP EL = 584.5 9. Replace Existing Air Release Valve (STA 049+00). INV EL = 581, TOP EL = 585.5 10. Install New Air Release Valve (STA 086+00). INV EL = 590.5, TOP EL = 595 11. Install New Air Release Valve at (STA 095+50). INV EL = 606.5, TOP EL = 611	1. Work to be performed during Low Flow Production Period. 2. Jim Miller Pump Station on-line, supplies Doran, Walcrest branches, Beltwood

Shutdown No.	DWG. No.	Transmission Main and Size	ARV Numbers	Maximum Duration of Shutdown	Procedure	Constraints and Remarks
5	685W 822 Sh 06 685W 822 Sh 07 685W 822 Sh 08 685W 822 Sh 08 685W 822 Sh 10 685W 822 Sh 11 685W 822 Sh 12	Walcrest Branch – 54"	W.1.N (STA 035+00) W.2.E (STA, 048+00) W.3.N (STA, 005+50) W.4.E (STA, 011+00) W.5.E (STA, 025+00) W.6.N (STA, 040+00) W.7.N (STA 049+40)	TBD	1. Close 48" BFV Valve (STA 0+12). INV EL = 487, TOP EL = 491.5 2. Close isolation valve at Walcrest Reservoir. 3. Drain with Blowoff Valve (STA 4+80). INV EL = 477.5, TOP EL = 482 4. Install New Air Release Valve (STA 035+00). INV EL = 551.5, TOP EL = 556 5. Replace Air Release Valve (STA 048+00). INV EL = 572.5, TOP EL = 577 6. Install New Air Release Valve (STA 005+50). INV EL = 586, TOP EL = 590.5 7. Replace Air Release Valve (STA 011+00). INV EL = 590, TOP EL = 594.5 8. Replace Air Release Valve (STA 025+00). INV EL = 586, TOP EL = 590.5 9. Install New Air Release Valve (STA 040+00). INV EL = 603.5, TOP EL = 608 10. Install New Air Release Valve (STA 049+40 o). INV EL = 624, TOP EL = 628.5	1. Work to be performed during Low Flow Production Period. 2. Jim Miller Pump Station on-line, supplies Doran, Abrams, Beltwood Reservoir.

Notes:

1- Blow-off valves and isolation valves stations are based on record drawings. Verify and confirm valves locations and operability with the help of Owner.

2- Elevations are based on record drawings, not actual survey. Verify elevations in the field.

Table 01 29 10-B Stakeholders List

No.	Related Valve	STA	Name	Address	Contact Information	Coordination/ Work Items
1	2.0.E	6+83	Bridgeport Apartments	5440 N Jim Miller Rd Dallas, TX 75227	214-388-5425	- Construction is in ROW - Notify if fence is damaged
2	3.1.E	113+04	Dallas Park & Recreation Department	1500 Marilla St. Suite 6FN Dallas, TX 75201	214-670-4100	Coordinate through DWU Project Manager
3	4.2.E	143+95	House Owner	7277 Williamson Rd Dallas, TX 75214	-	- Construction is in ROW - Notify
			Dallas Park & Recreation Department	1500 Marilla St. Suite 6FN Dallas, TX 75201	214-670-4100	Coordinate through DWU Project Manager
4	5.2.E	162+50	Dallas Park & Recreation Department	1500 Marilla St. Suite 6FN Dallas, TX 75201	214-670-4100	Coordinate through DWU Project Manager
5	6.2.E	174+00	Dallas Park & Recreation Department	1500 Marilla St. Suite 6FN Dallas, TX 75201	214-670-4100	Coordinate through DWU Project Manager
6	7.2.E	184+60	Dallas Park & Recreation Department	1500 Marilla St. Suite 6FN Dallas, TX 75201	214-670-4100	Coordinate through DWU Project Manager
7	8.2.E	194+40	Dallas Park & Recreation Department	1500 Marilla St. Suite 6FN Dallas, TX 75201	214-670-4100	Coordinate through DWU Project Manager
8	9.2.E	208+60	Dallas Park & Recreation Department	1500 Marilla St. Suite 6FN Dallas, TX 75201	214-670-4100	Coordinate through DWU Project Manager
9	11.8.N	140+00	Town of Addison Public Works and Engineering Department	16801 Westgrove Dr, Addison, TX 75001	972-450-2871	Coordinate with Town of Addison and acquire any necessary permits. Traffic control, construction site management, and site restoration shall conform to Town of Addison Code of Ordinances Chapter 70 and Chapter 71
			Celestial Pump Station	5510 Celestial Rd Dallas, TX 75254	972-450-2800	- Notify and coordinate work - Minimize disruptions to operations

No.	Related Valve	STA	Name	Address	Contact Information	Coordination/ Work Items
10	12.8.N	150+00	Town of Addison Public Works and Engineering Department	16801 Westgrove Dr, Addison, TX 75001	972-450-2871	Coordinate with Town of Addison and acquire any necessary permits. Traffic control, construction site management, and site restoration shall conform to Town of Addison Code of Ordinances Chapter 70 and Chapter 71
11	13.8.E	167+00	Davenport Apartments	14500 Dallas Parkway Dallas, Texas 75254	972-233-7200	Notify and coordinate work and lane closures at least 7 days before construction begins
12	14.10.E	033+90	Best Western Plus Hotel	14975 Landmark Blvd Dallas, TX 75254	972-701-0881	Notify and coordinate work at least 7 days before construction begins
13	D.1.N	027+50	Dallas Park & Recreation Department	1500 Marilla St. Suite 6FN Dallas, TX 75201	214-670-4100	Coordinate through DWU Project Manager
14	D.2.E	032+19	Dallas Park & Recreation Department	1500 Marilla St. Suite 6FN Dallas, TX 75201	214-670-4100	Coordinate through DWU Project Manager
15	W.1.N	035+00	House Owner	7171 Lavendale Ave Dallas, TX 75230	-	-Notify
16	W.2.E	048+00	House Owner	7029 Royal Ln Dallas, TX 75230	-	- Lane closure affects access to driveway - Notify and coordinate
17	W.6.N	040+00	Hillcrest High School	9924 Hillcrest Rd, Dallas, TX 75230	972-502-6800	- Construction will be in ROW - Lane closures will affect access to school - Perform work when schools are in recess
18	W.7.E	049+40	Walcrest Pump Station	9852-9898 Hillcrest Rd, Dallas, TX 75230	-	- Coordinate work with pump station operations

SECTION 09 01 90 - COLD-APPLIED WAX TAPE PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Work of this Section shall include contractor furnished and installed petrolatum (wax) tape for the protection of below-grade ferrous metal pipelines, valves, fittings and their accessories and hardware, where shown on the drawings.

B. All buried mechanical joint, flange, and sleeve clamping bolts, nuts and other mating accessories, regardless of configuration or service, shall be coated after field assembly with a cold applied pre-formed petrolatum tape coating system meeting the performance requirements included in AWWA C217 Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines, as specified below.

1.2 SUBMITTALS

A. Submit catalog cut sheets color chips and related information for coatings products proposed for use at the Site.

B. Submit material safety data sheets for all applicable coatings, and chemicals and additives to be used at the site for preparation and application of the coatings.

PART 2 - PRODUCTS

2.1 WAX TAPE PRIMER

A. The tape system shall include application of primer coat on all surfaces prior to application of the tape coating. The primer shall be non-toxic, non-carcinogenic, and nonflammable, having a minimum flash point of 350 degrees F. Primer shall be a blend of microcrystalline wax, plasticizer and corrosion inhibitors. Primer shall be moisture-displacing, rust penetrating, have a paste-like consistency and a pour point range of 100 – 110 degrees F. Primer shall be:

1. Wax tape primer, manufactured by Trenton Corporation, Ann Arbor, MI
2. TC Enviroprime, manufactured by Tapecoat, Evanston, IL.
3. Denso Paste, manufactured by Denso North America, Houston, TX.

2.2 WAX TAPE

A. The petrolatum tape system shall be manufactured of microcrystalline wax blend saturated into a non-woven, non-stitch bonded synthetic fabric forming a tape wrapper. A blend shall include a plasticizer and corrosion inhibitor, include no clay fillers and have saturation pour point range of 115 to 125 degrees F.

B. The tape thickness shall be 70 to 90 mils, and have a dielectric strength or 170 Volts/Mil, in accordance with ASTM D149. The application temperature range shall be 0 to 110 degrees F; and the service temperature range shall be -50 to 120 degrees F.

1. Wax Tape System No. 1, manufactured by Trenton Corporation, Ann Arbor, MI.
2. TC Envirocoat System, manufactured by Chase Tapecoat, Evanston, IL.
3. Densyl Tape, manufactured by Denso North America, Houston, TX.

2.3 FILM COMPONENT WRAPPER

A. Where shown on the Drawings, wax tape shall receive a component wrapper to cover the tape surface for protection during excavation backfill operations. The component wrapper shall be constructed of polyvinylidene chloride plastic bonded into a single sheet having a minimum thickness of 1.5 mil, ready for direct application to the wax tape. The component wrapper shall be:

1. Poly-Ply Outerwrap, manufactured by Trenton Corporation, Ann Arbor, MI.
2. Tapecoat V6 Outerwrap manufactured by Chase Tapecoat, Evanston, Illinois.
3. Poly-Wrap, manufactured by Denso North America, Houston, TX.

2.4 FIBERGLASS COMPONENT WRAPPER

A. Where shown on the Drawings, wax tape coatings shall receive a fiberglass component wrapper, having a minimum thickness of 0.005 inches. The wrapper shall be a moisture activated mesh weave fiberglass, having a minimum thread count shall be 20 wrap x 10 fill. The wrapper shall have a minimum tensile strength of 85 lb/in width. Fiberglass component wrapper shall be:

1. Glas-Wrap, manufactured by Trenton Corporation, Ann Arbor, MI.
2. T/R Rugged Wrap, manufactured by Chase Tapecoat, Evanston, IL.
3. Denso Glass, manufactured by Denso North America, Houston, TX.

PART 3 - EXECUTION

3.1 FIELD APPLICATION

A. Apply wax tape system in accordance with the manufacturer's instructions, NACE RP0375 Field-Applied Underground Wax Coating Systems for Underground Pipelines, and as specified herein. Use the more stringent method, in the case of conflicting instructions.

B. Wire brush surfaces in accordance with Surface Preparation Specification 2 SSPC SP-2 Hand Toll Cleaning for removal of all coarse granular material, followed by a thorough wipe down with a dry cloth, and then solvent clean where required, in accordance with Surface Preparation Specification 1 SSPC SP-1 Solvent Cleaning.

C. Prepare new and existing surfaces the same, except that power tools may be used to remove flaking, bonded coatings, and delaminated corrosion, in accordance with Surface Preparation Specification 3 Power Tool Cleaning SSPC SP-3.

D. Wax tape is moisture displacing, not water displacing, so wipe all surface water droplets dry with the cloth prior to primer application. Engineer's inspection will not accept surface preparation with loose rust, mill scale, old coating, dust or dirt. During winter, remove snow and ice from surfaces by heat application prior to coating.

E. Rub and press a thin film of primer into the areas of rusty and uneven surfaces (equivalent to approximately 1 gal/100 sq. ft.). Apply wax tape immediately following. Do not leave primer overnight for application of wax tape the following morning.

F. Spiral-wrap wax tape on straight pipe, with a minimum 1 inch or 50% overlap, whichever is greater, with slight tension on the tape at all times. Wrap vertical pipe surfaces in the upward direction, starting from the low end. Press and smooth out lap seams to ensure they're sealed. Overlap tape wrap a minimum 4 inches, feathered-out over existing coatings, and leave cut-backs exposed.

G. When applying tape to uneven irregular surfaces, i.e. valves, fittings, fasteners, etc., allow slack during application such that the tape can be molded into conformity. Press and form the tape so that there are no air pockets or voids beneath the tape.

3.2 FIELD INSPECTION

A. Following application, Engineer will immediately inspect wax tape in accordance with NACE RP0375 Field-Applied Underground Wax Coating Systems for Underground Pipelines, and the requirements specified herein. Wax tape shall be visually inspected for irregularity and bonding defects, such as air gaps and blistering. Where these defects are detected, immediately perform repairs such that follow-up inspection may be performed in an expedient manner.

B. Inspect wax tape coating for holidays in accordance with NACE RP0274 High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation. Set voltage at 170 Volts/mil of cold-applied wax tape coating, plus the additional voltage recommended for the component wrapper, as recommended by the Supplier.

END OF SECTION 09 01 90

SECTION 33 01 10 - IN-SERVICE TAPPING OF CONCRETE PRESSURE PIPELINES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Materials and performance requirements for tapping and plugging AWWA pre-stressed concrete cylinder (PCCP) pressure pipelines.

1.3 DEFINITIONS

A. Tapping Valve: A valve remaining in the line after the work of this section is complete.

B. Sandwich Valve: A temporary valve removed after the work of this section is complete.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components for tapping sleeve body, flange, gasket, bolts, and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Installation Plan: Include step by step descriptions of methods to install the tapping fittings and related equipment. Include:

1. Location of the existing pipelines and the proposed installation location of the tap, including the proposed method of supporting the existing pipeline at that location.
2. Detail drawings of the proposed pipe tapping and support equipment showing equipment and fitting positioning and overall dimensions and weights.
3. Detail drawings and description of materials of the proposed tapping fitting, including blind flange.
4. Statement or literature indicating the design pressure rating of the tapping fitting and tapping machine.

1.6 QUALIFICATIONS

A. Retain the services of a specialty subcontractor to perform the in-service pipeline tapping and plugging. Demonstrate experience with tapping and plugging on buried pipelines of similar sizes. Submit experience record from the past 5 years listing name of project, client, location, description, methods applied, and contact information.

B. Field quality-control reports. Before tapping operations begin, confirm pipe measurements to ensure correct sleeve size for the pipe.

1.7 PIPE MANUFACTURER'S REPRESENTATIVE

A. Retain the PCCP pipe manufacturer's on-site technical services, and include the cost in the pipe tap bid items. On-site technical services technician shall be in the field at the beginning of construction, periodically during construction, at each site when final grouting, concrete encasement and back fill are completed, when issues occur requiring the attention of pipe manufacturer, and as requested by the Owner for the duration of the project.

B. Contractor shall coordinate with the PCCP pipe manufacturer's on-site technician to plan, design, execute, test, and inspect pipe tapping to ensure successful completion while maintaining the integrity of the PCCP pipe.

PART 2 - PRODUCTS

2.1 TAPPING SLEEVES FOR CYLINDER PCCP PIPELINES

A. Tapping sleeves for PCCP shall be the semi-circular type consisting of five parts, including a grouted top sleeve assembly with a gusseted draw flange at the outlet nozzle. The top sleeve/grout assembly shall bear and seal against the pipe wall by clamping action using a treaded strap-and-nut assembly. The strap-and-nut assembly shall be installed through break-formed lugs welded to the sleeve. The strap-and-nut assembly shall be assembled to clamp against the pipe wall with a sufficient number and size of straps for the specified operating pressure.

B. The top sleeve section and strap assembly shall be shaped accurately to fit around the pipeline with a gasketed perimeter designed to contain seal the assembly and contain a grout fill. The gasket shall be constructed of molded ASTM D2000 Nitrile Butadiene Rubber (Buna-N), installed using a bonding compound for retention. sleeves used in water systems having finished water treated with chloramines shall be furnished with end-gaskets constructed of peroxide cured ethylene propylene diene monomer in accordance with ASTM D2000 call-out M4CA 710 A25 B35 C32 or equivalent.

C. Bolts shall be Stainless Steel, 18-8 Type 304.

D. Finish: Fusion Epoxy Coating on entire sleeve per ANSI/AWWA C-213.

E. A minimum 1-in outlet with plug shall be installed on the outside surface of the top sleeve nozzle, which shall permit a leakage test between the top sleeve and pipe outer wall prior to installation of the grout fill. The top sleeve/ grout assembly shall be fitted with grout horns of sufficient size for pouring the grout within the cavity between pipe and sleeve without the use of special grouting equipment. The complete grouted assembly shall provide adequate structural support for the existing pipe segment before and after removal of the coupon by tapping.

F. The thickness of the tapping sleeve/grout assembly components shall be based upon the design calculations for the operating pressure of the pipe system and the grade of the steel used for the sleeve. The top sleeve/grout assembly materials shall be ASTM A 283 Grade C, ASTM A 36, or equivalent.

G. A separate tapping gland shall fit concentrically within the top sleeve nozzle, bearing against the exposed steel cylinder creating a seal by use of an end-bearing gasket and fully threaded jacking studs and nuts installed through concentric holes bored in the draw flange and tapping gland flange. All hardware shall be coated with a cold applied pre-formed petrolatum tape coating system in accordance with Section 090190.

H. The end-gasket shall be constructed of molded ASTM D2000 Nitrile Butadiene Rubber (Buna-N), installed using a bonding compound for retention. The tapping gland shall be fitted with a flanged nozzle, completion plug, and completion flange. The nozzle flange shall be tapped for fully-threaded studs used to attach the temporary sandwich valve. The tapping gland materials shall be ASTM A 283 Grade C, ASTM A 36, or equivalent.

1. Style 415 manufactured by JCM Industries, Nash, TX.
2. Style FTS435 manufactured by Romac Industries, Bothell, WA
3. Style 625 manufactured by Smith-Blair Inc., Texarkana, TX.

2.2 GROUT

A. Slump: 8 to 11 in per ASTM C143.

B. Minimum compressive strength: 2000 psi at 28 days.

C. Per ASTM C476 Grout for Masonry.

PART 3 - EXECUTION

3.1 SUGGESTED SEQUENCE OF CONSTRUCTION

A. An installation narrative and suggested sequence of construction are described in the following paragraphs.

1. Carefully, chip away mortar coating from the area where tap is to be made. Expose but don't damage the prestressing wires and steel cylinder.

2. Position the sleeve in place, tightening all the straps around the pipe. Pour grout into the grout ports in the sleeve, filling the space between the sleeve and pipe. Use fast-setting, early-strength portland cement grouts to reduce time required for grout to set. Allow the grout to set. Ensure pipeline pressure does not exceed the safe tapping pressure for the cylinder. Cut reinforcing wires to provide clearance for the gland to seal against the cylinder. For embedded cylinder pipe, remove outer portion of the concrete core to expose the cylinder. Use pneumatic chipping hammers in the removal of the mortar and outer core.
3. Position the gland in the sleeve with its rubber gasket against the pipe steel cylinder. Evenly tighten the outer circle of bolts connecting the two flanges to compress the gasket against the steel cylinder to achieve a permanent watertight seal. Engage the stabilizing set screws through the gland flange against the face of the sleeve flange. Seal the gland flange and test the cavity and gland gasket seal for water tightness. The fluid pressure must not exceed the pressure inside the pipe being tapped.
4. Remove the gland flange seal. If required for larger taps, secure the concrete core to be cut to the steel cylinder coupon using special toggle equipment.
5. Attach a sandwich tapping valve to the gland flange with the inner circle of bolts. Pressure test to ensure a watertight flange seal.
6. Connect the tapping machine to the valve. Ensure that the sleeve and gland do not carry the weight of the valve and tapping machine. Provide support for both pieces throughout and after the tapping procedure.
7. Open the valve completely. Advance the cutter using the hand screw through the opened valve to the steel cylinder of the pipe. When power is applied, the pilot drill will begin to cut the cylinder. Resistance to feed will suddenly increase as the shell cutter contacts the pipe cylinder and begins its circular cut. When the automatic feed screw has advanced the proper predetermined distance, the cut is complete.
8. Withdraw the cutting head past the gate and close the valve. Disconnect the tapping machine. Open the valve slightly to flush out any small cuttings that remain. Fill the space between the sleeve and gland with grout and apply a protective coating of cement mortar over the entire assembly.
9. Remove sandwich tapping valve.

3.2 INSTALLATION

A. Excavate test pits and perform an initial field inspection of the pipe to receive the wet tap under the supervision of the Engineer.
   1. Verify the location of the tap and determine the condition of the existing pipeline and exact dimensions (outside diameter and ovality) prior to shop fabrication of the tapping fitting. Verify the cylinder dimension in the field.
   2. On steel, gray and ductile iron pipe, verify the actual thickness of the pipe wall at the location of the tap by ultrasonic thickness testing. Perform test by a minimum ASNT Level II NDE Inspector.

B. Following fabrication, install the tapping fitting on the pipeline. If the fitting is installed by welding, notify the Engineer at least 48-hours prior to performing the work. This will provide time to schedule the NDE examination of the welds by the Owners inspection consultant.

C. After the welds are successfully inspected, and prior to the installation of the tapping valve, conduct a leakage test using the 1-in diameter outlet connection included in the nozzle section of the tapping fitting.

1. Carry out using water at a pressure of 150-psi for ½ hour. Perform test with Engineer present.

D. After a successful leakage test, coat the longitudinal mating through-bolts on the tapping fitting with petrolatum tape, and form and pour a concrete support cradle around the fitting, as indicated on the drawings.

E. Install the tapping or sandwich valve and tapping machine. Provide a clean cut at the pipe wall, and retain the cut coupon for removal. Perform the tap and withdraw the cutter upon approval from the Engineer.

F. For PCCP tapping, consult the pipe manufacturer for the maximum permissible operating pressure the pipe can withstand after the prestressing wires are removed to expose the cylinder.

3.3 FIELD WELDING

A. Do not deviate from applicable codes, approved procedures and approved shop drawings without prior written approval from the Engineer. Materials or components with welds made off the site will not be accepted if the welding does not conform to the requirements of this specification unless otherwise specified.

B. Assign each welder or welding operator an identifying number, letter, or symbol to be used to identify his welds. Have each welder or welding operator apply his mark adjacent to his weld using an approved rubber stamp or felt-tipped marker with permanent, weatherproof ink or other approved methods that do not deform the metal.

C. Follow the procedures necessary to prevent burn-through, which will result in a leak and the need for a shut-down. If the temperature of the base metal is lower than 50°F, preheat the weld area to the temperature required by the Welding Procedure Specification (WPS) . When the surface temperature of the pipe is below the atmospheric dew point, pre-heat or use another method to reduce the moisture content in the weld area.

D. Use care when installing the hot tap/line-stop fitting and during welding to prevent misalignment, which could have detrimental effects during operation of the tapping machine.

3.4 EXAMINATION OF WELDS

A. Full-Penetration Butt Welds

1. Examine the root and final cover pass of all full penetration butt-welds visually (VT) and by magnetic particle (MP) testing. Grind the root pass prior to examination, as specified in Table 341.3.2 in ASME B31.3.

B. Fillet Welds at Slip-On Flanges

1. Examine fillet welds at slip on flanges by VT and MP testing, as specified in Table 341.3.2 in ASME B31.3.

C. Remove defects and replace welds as specified in ANSI Piping Standards, unless otherwise specified. Repair defects discovered between weld passes before additional weld material is deposited.

1. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface, eliminating sharp notches, crevices, or corners.
2. After defect removal is complete and before rewelding, reexamine the area by the same test methods which first revealed the defect to ensure that the defect has been eliminated.
3. After rewelding, reexamine the repaired area by the same test methods originally used for that area.

D. For repairs to base material, examine the same minimum examination as required for butt welds. Reevaluate all indications of a defect by non-destructive evaluation or by surface conditioning to show that no unacceptable indications are present. Do not use foreign material to mask, fill in, seal, or disguise welding defects.

END OF SECTION 33 01 10

SECTION 33 05 39.13 - PRESTRESSED CONCRETE PRESSURE PIPE – STEEL CYLINDER TYPE (AWWA C301)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Prestressed concrete cylinder pipe (Pipe)
2. Pipe fittings
3. Gaskets for all pipe joints
4. Mortar for inside and outside joints of all pipe
5. Testing of materials, pipe, and pipelines.

1.2 COORDINATION

A. Coordinate Work of this Section with general and special conditions of the project.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Submit shop drawings to the Engineer for approval before manufacture and shipment.

1. Indicate all details of reinforcement, concrete and joint dimensions for all pipe and fittings.
2. Submit a tabulated laying schedule which references stationing and invert elevations as shown on the drawings including; all fittings, bevels, restrained joints, outlets, tees, bends, adapters, closures, and specials.

    a. Show pipe class, class coding, station limits, and transition stations for various pipe classes in the laying schedule.
    b. The locations of all pipes shall conform to the locations indicated on the drawings.

B. Production and Delivery Schedule: Submit anticipated production and delivery schedule.

C. Pozzolanic materials: Pozzolanic materials are permitted for use as a cement replacement. Submit data on pozzolanic materials.

D. Admixtures: Admixtures are permitted for use. Submit product data on admixtures planned.

E. Manufacturer's Certificate: Prior to shipment of pipe, submit certified affidavit of compliance stating that the pipe for this Contract was manufactured, inspected and tested in accordance with the AWWA Standards specified herein.

F. Design Data:

1. Submit applicable pipe design data in accordance with AWWA C301 and C304, including the following:

   a. Type of Pipe

      1) Lined Cylinder (L-301) Not Allowed
      2) Embedded Cylinder (E-301)

   b. Cylinder Data

      1) ASTM designation and grade
      2) Thickness and nominal diameter
      3) Test pressure

   c. Prestressing Wire Data

      1) ASTM designation and class
      2) Size
      3) Area
      4) Wire spacing
      5) Minimum ultimate strength
      6) Wrapping stress

   d. Concrete Data

      1) Type of cement
      2) Concrete mixture proportions
      3) Minimum compressive strength at time of wrapping
      4) Minimum compressive strength at 28 days
      5) Core thickness
      6) Minimum coating thickness

   e. Mortar Data

      1) Coating thickness

2. Submit design calculations in accordance with AWWA C304, certified by a professional engineer licensed in the state(s) where installation will take place. Calculations shall include the burst pressure (Pb) and maximum internal pressure (Pk'). Clearly indicate all calculation constants for this specific project.

G. Weld Data and Welder Qualifications:

1. Submit in accordance with AWWA standards, welder qualifications and welding procedure(s). See sections 4.6.2 and 4.6.3 in AWWA C301 for additional details on welder qualifications and welding procedure.
2. All welders and welding operators shall be qualified under AWS D1.1 Structural Welding Code – Steel, under AWS D1.3 Structural Welding Code – Sheet Steel, or under Sec. IX of the ASME Boiler and Pressure Vessel Code for Welding P – No. 1 (carbon or low alloy) steels. Welders and the welding operators qualified under Sec. IX of the ASME Boiler and Pressure Vessel Code to weld P – No. 1 steels shall be deemed qualified to weld any combination of steels listed in Sec. 4.6 of AWWA C-301. Each welder and welding operator shall have qualified or requalified within the past three (3) years.
3. Submit proof of certification for welders. Indicate certified procedures and position each welder is qualified to perform. Provide documentation of the most recent weld qualification test date and continuity of use in each process for which the welder or welding operator is required.

H. Test and Evaluation Reports:

1. The manufacturer shall submit test reports during the manufacture of the pipe at the discretion of the Engineer. Test reports shall include the items specified by AWWA 301.

    a. Steel
    b. Cement
    c. Gasket Rubber

I. Manufacturer's Technician for Pipe Installation

1. During construction period, the pipe manufacturer to provide the services of a factory-trained, qualified, job-experienced technician for assistance as necessary in pipe laying and pipe jointing. Assist and advise the Contractor in pipe laying and jointing operations and instruct construction personnel in proper pipe laying, joint assembly, and joint inspection procedures. The technician is not required to be on site full time. Technician to be on site as requested by the Engineer, Owner, or Contractor.

J. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

K. Field Quality-Control Submittals: Indicate results of Contractor furnished tests and inspections.

1. Field pressure/leakage tests.

L. Qualifications Statements:

1. Submit qualifications for manufacturer,.

    a. Certification by the American Concrete Pressure Pipe Association (ACPPA) or certification under International Standards Organization (ISO) quality control

standards.

1.4 QUALITY ASSURANCE

A. Qualifications

1. The materials specified herein are intended to be standard types of prestressed concrete cylinder pipe and fittings for use in transporting water under pressure.
2. The pipe and fittings shall be manufactured for this project and installed in accordance with industry standards and methods and shall comply, in all respects, with requirements specified herein. The pipe and fittings shall also comply with the latest edition, at the time of bid, of all referenced standards and specifications.

B. Inspection of the pipe and fittings may be made by the Engineer upon delivery at the site. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though the pipe may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once, unless otherwise specified by the Engineer.

C. Tests on concrete, mortar, steel, cylinder assembly, calibration of test equipment, and rubber gaskets shall be sent to Contractor's Independent Testing Laboratory in accordance with Section 5.2 of the AWWA C301. The Independent Testing Laboratory shall review all reports for conformance with AWWA C301 and AWWA M9, and provide signed certification of conformance along with copies of all reports, to the Engineer.

D. The Contractor shall provide and pay for the services of an independent certified laboratory to certify the Proof of Design Tests and all Shop Production Tests performed by the pipe manufacturer.

1. Submit to the Engineer a list of at least three independent, certified testing laboratories that have demonstrated experience in the type of testing required. The Owner will select from the list the testing laboratory to provide the certification. Complete Statements of Qualifications and Experience shall be submitted for each testing laboratory including at least the following:

   a. Complete listing of projects which laboratory has provided similar services for over the last 5 years, including:

      1) Project dates
      2) Project owners
      3) Type of pipe
      4) Pipe diameters and lengths
      5) Type and number of tests performed
      6) References

   b. Same information for the person(s) proposed by each laboratory to perform inspection for this project.

2. The Independent Testing Laboratory shall witness and certify all Proof of Design Pipe Tests as specified herein. The Laboratory shall also witness all Shop Tests on Production Run Pipe as specified herein. Pipe to be tested shall be chosen randomly by the Independent Testing Laboratory from each lot.
3. The Independent Testing Laboratory shall inspect and stamp each and every length of pipe prior to it leaving the manufacturer's plant and certify that the pipe is not cracked, chipped, or damaged.
4. All certifications shall be signed by an officer of the Independent Testing Laboratory.
5. The Owner reserves the right to attend Proof of Design Pipe Tests and Shop Production Pipe Tests.
6. The Owner reserves the right to provide services of an independent testing agency to verify the testing of the pipe.
7. The manufacturer shall make gauges that are necessary for inspection available for the Owner or Owner's Representative use. The manufacturer shall assist the Owner or Owner's Representative with the handling of pipe and fittings necessary.

E. Proof of Design Tests

1. Conduct Proof of Design Tests at the manufacturer's plant according to the following procedures:

    a. Hydrostatic Proof of Design Test

        1) One full length of pipe for each pipe size and design class furnished shall be selected at random and subjected to a hydrostatic test to destruction. Test pipe must be a minimum of 7 days old at time of test. The exterior mortar coating may be soaked for a maximum of 48 hours prior to conducting the test.
        2) The pressure within the pipe shall be slowly increased. The exterior surface of the pipe shall be inspected for cracking at Pw and at Po.
        3) At Pw, there shall be no visible cracks in the mortar coating along the prestressed portion of the pipe.
        4) At Po there shall be no visible coating crack along the prestressed portion of the pipe.
        5) The pressure in the pipe shall then be increased to a pressure of Pw plus Pt, held for 1 minute, then reduced to Pw. After 5 minutes at Pw, there shall be no visible coating cracks along the prestressed portion of the pipe.
        6) The pressure in the pipe shall then be slowly increased until visual cracking is evident. Failure will be defined as that pressure producing a crack 0.001-in wide and 12-in in length. The test pressure producing such a crack must be equal to or greater than the Pk′ as defined in manufacturer's specification data submittal.
        7) Upon reaching or exceeding the value of Pk′ as established in the manufacturer's specification data submittal, the internal test pressure shall be reduced to Pw. The area of the crack(s) shall be re-inspected. The crack(s) shall have closed.
        8) The pressure in the pipe shall then be slowly increased to the ultimate failure of the pipe. The pressure at ultimate failure shall be equal to or greater than

the value as established in the manufacturer's specification data submittal.

9) Should the length of pipe fail to meet the specified criteria, two additional lengths of pipe shall be randomly selected for testing. Testing shall be as prescribed previously. Should either of these two pipes fail to meet the specified criteria, the manufacturer shall redesign the pipe for that class.

10) Redesigned pipe shall be subject to the same testing procedures.

F. Production Testing

1. In addition to the above proof of design tests, production testing on a minimum of one pipe length per 50 manufactured for this Contract shall be performed.
2. The production tests shall be as follows:

   a. The Independent Testing Laboratory will randomly select one pipe out of each lot of 50 manufactured for the project.
   b. The pipe shall be subjected to an internal pressure test.
   c. The internal pressure of the pipe shall be increased to a pressure equal to Pw plus Pt, held for 1 minute, then reduced to Pw. After 5 minutes at Pw, there shall be no visible coating cracks along the prestressed portion of the pipe.
   d. Pipe lengths passing the production in-plant testing may be shipped and installed in the project.
   e. Should the pipe length fail to meet these requirements, two additional lengths of pipe from the same lot of 50 will be tested as specified herein. Should either of these pipes fail to pass this test, the entire lot of 50 shall be rejected.
   f. All costs associated with pipe testing shall be paid for by the Contractor.

G. Perform Work according to AWWA C-301 for all pipe, fittings, and specials.

1.5 QUALIFICATIONS

A. Manufacturer:

1. All prestressed concrete cylinder pipe, fittings and specials shall be furnished by a single reputable manufacturer with a minimum of 5 years of experience in manufacturing prestressed concrete cylinder pipe of the size(s) specified for this project.
2. The pipe manufacturer shall be a member of the American Concrete Pressure Pipe Association and the manufacturing facility shall have a current Lloyd's Register Audit Certification for the manufacture of prestressed concrete cylinder pipe (AWWA C301).
3. The pipe, fittings and specials shall be designed, manufactured and installed in accordance with industry standards and methods and shall comply with specification requirements as stated herein.

B. Pipe Manufacturer's Field Service Representative: The pipe manufacturer shall provide a qualified Field Service Representative, who shall be available to be on the project site upon proper notice.

1. The Field Service Representative shall be an employee of the pipe manufacturer.
2. The Field Service Representative shall have experience as a representative of the

manufacturer in the area of providing such field services.

C. Fabricator: Company specializing in fabricating products specified in this Section with minimum five years' documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Legibly mark all pipes, fittings, specials, and appurtenances to be consistent with laying schedule and marking drawings. Each pipe shall be identified with sequential numbering and each marked pipe will appear on marking drawings in the identified locations for installation. Special fittings, bends, and appurtenances requiring a specific orientation will be appropriately marked with the words "TOP" in the correct position and in a consistent location.

B. Care shall be taken during storage, loading, transporting, and unloading to prevent damage to the pipe or coatings. See also AWWA C301 and AWWA M9 for shipping, handling, and storage procedures. Pipe or fittings shall not be dropped. All pipe or fittings shall also be examined as noted in Division 1. Any damage to linings or coatings discovered during examination shall be repaired to the satisfaction of the Engineer at the Contractor's cost before the pipe is installed. Pipe shall be transported from the final place of manufacturing to the jobsite on padded bunks or timbers with nylon tie-down straps or padded banding. Pipe shall not be stacked higher than the limits recommended by its manufacturer.

C. All pipe and fittings shall be thoroughly cleaned, and shall be kept clean until they are used in the work.

D. Deliver materials in manufacturer's packaging including application instructions.

E. Inspection: Inspect pipe for damage upon delivery to the site. Reject and replace all damaged pipe.

F. On site storage of pipe is not allowed..

G. Protect the pipe and coating during transportation and storage.

1.7 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Unless otherwise specified herein, the design, materials and workmanship for pipe shall conform to the requirements of AWWA C301. Core and coating thickness for pipe shall be as

specified in AWWA C301.

1. All pipe shall be new, and not supplied from inventory.
2. Piping shall be installed in those locations as shown on the Drawings, and only where specifically indicated.
3. Dimensions and elevations for all piping shall be field verified by the Contractor.
4. The items and materials specified herein are intended to be prestressed concrete cylinder pipe for use in transporting water under pressure.
5. Note information in Pipe Schedule, on drawings, and in this Section especially concerning pressures, coating and cores, minimum thickness, etc. In case of a conflict, the more stringent information in the Engineer's opinion shall govern.

B. Manufacturer List:

1. Approved Manufacturers:

   a. Thompson Pressure Pipe Group

      1) Address: Grand Prairie, Texas, USA
      2) Telephone: 972.262.3600
      3) Website: www.thompsonpipegroup.com

   b. Ameron Water Transmission Group

      1) Address: Rancho Cucamonga, California, USA
      2) Telephone: 909.944.4100
      3) Email: novameronpipeinfo@nov.com

   c. DECAST, Ltd.

      1) Address: Utopia, Ontario, Canada
      2) Telephone: 800.461.5632
      3) Email: mdefranco@decastltd.com

2. Substitutions: Not permitted.

C. Performance and Design Criteria: Pipe shall be designed in accordance with AWWA C304, using the design parameters as specified herein. These parameters shall also be used in the design of any fittings and specials that include an interior and exterior coating of portland cement mortar on the steel cylinder.

1. Internal Pressure

   a. Design Working Pressure (Pw) shall be 175 psi.
   b. Transient (surge) Pressure (Pt) shall be 100 psi.
   c. Field Test Pressure (Pft) shall be 1.5 Working Pressure psi.

2. External Loading

a. Earth Loads: Earth loads shall be computed using Marston equations for trench conditions based on the following:

1) Depth of cover as shown on project plans
2) A minimum cover of 6-ft.

3) Trench width as shown on project plans
4) Unit Soil Weight = 120 pounds per cubic foot

b. Olander Coefficients: Olander coefficients shall be based on the following:

1) Bedding Type: S3
2) Bedding Angle: zero degrees.

c. Live Loads: Live loads shall be computed in accordance with ACPA Concrete Pipe Design Manual or Concrete Pipe Handbook, based on the following:

1) AASHTO HS-20 or CHBDC CL-625, Section 3.8.3.2 for two (2) trucks passing
2) AREMA Cooper E-80 for pipe within a railroad right-of-way and not in a tunnel liner or casing

3. Thrust

a. In areas where the pipe alignment will be subject to unbalanced hydrostatic thrust forces (i.e., at bends, tees, bulkheads, wyes or valves), the unbalanced forces shall be addressed in accordance with AWWA Manual M9.
b. Where pipe restraint is required, lengths of restrained joint pipe and cylinder thickness shall be computed using the method contained in Chapter 9 of AWWA Manual M9.
c. Acceptable types of restrained joints shall be as shown in AWWA Manual M9.

4. Core Thickness: The minimum design thickness of the core shall be 1/16 of the nominal pipe diameter.
5. Core Thickness Tolerance: The core thickness, except at the joints, shall not be less than that shown on the drawings by more than five (5) percent or by more than 0.125 inch for pipe up to 36 inches in diameter, by more than 0.188 inch for 42-inch through 48-inch pipe, by more than 0.25 inch for 54-inch through 72-inch pipe, or by more than 0.375 inch for pipe larger than 72 inches, whichever is greater.
6. Lengths: The manufacturer shall designate the standard length to be furnished, and all standard pipes shall be uniformly of that length. To meet special requirements as approved by the Engineer, pipe sections may be furnished shorter than the standard length.

D. Joints

1. Each length of standard pipe shall have a steel bell ring and a steel spigot ring welded to the steel cylinder. The spigot ring shall have a groove in its exterior for the purpose of

retaining the solid O-ring rubber gasket, which shall seal the joint under normal conditions of service.

2. Gaskets shall be of sufficient volume to substantially fill the space provided when the joint is assembled and will function solely to seal the joint.

E. Fittings

1. Steel plate thickness of all fittings shall be designed in accordance with Chapter 8 of AWWA Manual M9. Fittings shall be designed for the same internal pressure and external load conditions as the adjacent pipe.

F. Prestressing

1. Wrapping Stress: The design gross wrapping stress in the prestressing wire shall be 75 percent of the specified minimum tensile strength of the wire.
2. Wire Spacing

   a. The design center-to-center spacing of wires shall not be less than 2.75 wire diameters for lined cylinder pipe and 2.00 wire diameters for embedded cylinder pipe.
   b. The maximum center-to-center spacing shall not exceed 1.5 inch, except for lined cylinder pipe with ¼ inch or larger wire, the maximum center-to-center spacing shall not exceed one (1) inch.
   c. The number of wraps of prestressing wire along any 2-foot length of core shall not be less than required by the design.

G. Cover: The minimum cover provided by the cement-mortar coating shall be 0.75 inch over the prestressing wire.

2.2 MATERIALS

A. Concrete and Mortar

1. Portland Cement: Portland cement shall conform to ASTM C150, Type II. Cement shall be stored in a dry, well-ventilated location protected from the weather. If the temperature of the cement exceeds 150°F, it shall not be used until cooled to less than 150°F, or the measures recommended in ACI 305R are applied to control the effect of high temperature.
2. Cement Replacement Material: Fly ash, natural pozzolan or silica fume may be used as a partial cement replacement. The replacement material shall conform to ASTM C618 or ASTM C1240. Storage requirements for cement replacement material shall be the same as portland cement.
3. Aggregates: Aggregates shall conform to ASTM C33.
4. Water: Water used in mixing and curing concrete and mortar may be fresh or recycled and shall be clean and free from deleterious amounts of oil, acids, alkalies and organic material.
5. Admixtures: Admixtures conforming to ASTM C494 may be used unless otherwise specified. The use of admixtures containing chlorides is prohibited.

6. Concrete for Pipe Core:

   a. The proportions of portland cement, cement replacement material (if used), fine aggregate, coarse aggregate and water used in the concrete for pipe cores shall be determined and controlled to provide a uniform, dense and durable mix.
   b. Concrete shall have a portland cement content of not less than 560 pounds per cubic yard, except that up to 20 percent by weight of the cement may be replaced by an approved fly ash or natural pozzolan or up to ten (10) percent by weight of the cement may be replaced by an approved silica fume.
   c. The water-soluble chloride ion (Cl^-) content of the concrete mix, expressed as a percentage of the weight of cementitious material, shall not exceed 0.06 percent.

7. The minimum compressive strength of concrete at the time of prestressing shall be 3,000 psi for pipe cores produced by vertical casting and 4,000 psi for pipe cores produced by the centrifugal method or radial compaction, or 1.82 times the initial compression induced in the concrete core, whichever is greater.
8. The minimum 28-day concrete compressive strength shall be 4,500 psi for pipe cores produced by vertical casting and 6,000 psi for pipe cores produced by the centrifugal method or radial compaction, or as required by the pipe design, whichever is greater.
9. To satisfy the 28-day strength requirements, a set of at least two (2) standard test cylinders shall be made each day from the mixed concrete for pipe cores. In addition, for determining the strength of concrete in the cores prior to prestressing, two (2) standard test cylinders shall be made each day for each 50 cubic yards of concrete for each mix design placed in a day, or two (2) standard test cylinders per pipe core, whichever requires the lesser number of cylinders. The concrete shall be removed from the mix in accordance with ASTM C172. Test cylinders shall be made in conformance with ASTM C31. The initial curing of the test cylinders shall be at the same temperature, for the same total length of time and by the same means (accelerated cure, water or combination) as applied to the pipe. After initial curing, cylinders made for the determination of strength for prestressing shall be stored in the same environment as the pipe cores. All test cylinders shall be tested in accordance with ASTM C39.
10. The moving average strength of any ten (10) consecutive strength tests of cylinders representing the 28-day strength for each mix design shall be equal to or greater than the required strength. Not more than two (2) of ten (10) strength tests shall have less than the required results. In no case shall the strength of any cylinder tested be less than 80 percent of the specified strength.
11. Cement Mortar for Coating: Cement mortar used for coating shall consist of one (1) part of cement to not more than three (3) parts of fine aggregate by weight and a minimum water content of seven (7) percent of the total dry weight of cement and aggregate. Cement mortar rebound not to exceed ¼ of the total mix weight may be used as a sand replacement; however, the resulting mix proportions shall be a minimum of 1:3. Rebound not used within one (1) hour shall be discarded. The soluble Cl^- content of the mortar-coating mix, expressed as a percentage of the weight of cement, shall not exceed 0.06 percent.

B. Prestressing Wire

1. Wire for circumferential prestressing shall conform to ASTM A648, Class III, with

amendments to the standard as described in the following sections. The wire shall be protected at all times from physical damage or deterioration.

2. Minimum Wire Diameter: Prestressing wire shall be a minimum No. 6 gauge (nominal diameter 0.192 inch).
3. Tensile Test: A tensile test shall be made on a specimen taken from each coil of wire. The maximum tensile strength shall not exceed the minimum required tensile strength by more than 30 ksi. The tension tests shall be made in accordance with methods and definitions of ASTM A370, Supplement IV.
4. Reduction of Area Test: Reduction of area shall be determined on each tensile test specimen. The reduction of area shall not be less than 35 percent for No. 6 gauge wire and 30 percent for ¼-inch and 5/16-inch diameter wire. The reduction of area shall be determined in accordance with the methods and definitions of ASTM A370, Supplement IV.
5. Torsion Test: A continuous torsion test shall be made on a specimen taken from one (1) of five (5) coils or fraction thereof in a lot. A lot is the number of coils of the same heat number. The tests shall be made at rotational speeds of 10-20 rotations per minute and with an end load of 0.5 to two (2) percent of the load that would produce the minimum breaking strength of the wire. Failure of the test sample is defined as separation of the sample into two (2) or more pieces. Torsion test shall be made in accordance with methods and definitions of ASTM A938. The number of turns to failure shall be commensurate with the following table:

Nominal Wire Size	Minimum Turns per Foot
6 gauge	8
¼-inch	7
$^{5}/_{16}$-inch	6

6. Hydrogen Embrittlement Test: Prestressing wire shall meet the hydrogen embrittlement testing requirements of ASTM A648, Supplemental Requirement S1 and ASTM A1032.
7. Chemical Requirements: The chemical analysis of the steel used in manufacturing the wire shall conform to the requirements of ASTM A648 as specified in the following table:

Chemical	Class III
Carbon %	0.50-0.85
Manganese %	0.60-1.00
Silicon %	0.10-0.35
Phosphorus – maximum %	0.30
Sulfur – maximum %	0.30

C. Steel Cylinder

1. Steel sheet for pipe cylinders shall have minimum yield strength of 36,000 psi, minimum elongation at rupture of 15 percent (2-inch gauge length) and shall meet the requirements of ASTM A659, ASTM A1011, ASTM A1018 or ASTM A1039.
2. Steel plate for pipe cylinders and fittings shall conform to ASTM A36, ASTM A283 or ASTM A285.

D. Joint Rings

1. Steel for joint rings shall have minimum yield strength of 33,000 psi and minimum elongation of 20 percent (2-inch gauge length).
2. Steel strip for bell rings shall conform to ASTM A1011 or ASTM A1018.
3. Steel plate for bell rings or special shapes for spigot rings shall conform to ASTM A36, ASTM A283, ASTM A576 (Grade 1012 or 1015) or ASTM A675 (Grade 50, leaded steel excluded). Merchant quality bars conforming to ASTM A575 (Grade M1012 or M1015) or ASTM A663 (Grade 50) may be used, provided the surface finish is satisfactory.

E. Gaskets

1. Gaskets for the joints shall be continuous solid rings made of a composition of natural or synthetic polyisoprene rubber. The cross section of gaskets shall be circular with a diametral tolerance of plus or minus 0.015 inch. Surfaces of gaskets shall be smooth and free from pits, cracks, blisters and other imperfections. The rubber compound shall be dense, homogeneous and free from porosity and air pockets, and shall contain no rubber substitute, reclaimed rubber or deleterious substance.
2. Two (2) splices in each gasket will be permitted, provided the length of gasket between splices is at least 24 inches. Gaskets shall be stored in a cool, dry area and protected from direct sunlight.

2.3 MANUFACTURING

A. Equipment

1. The manufacturer shall furnish necessary plant, storage facilities, forms and equipment for manufacturing and curing the pipe and testing the components.

B. Steel Cylinders

1. Forming: The steel sheets or plates shall be formed into cylinders having transverse, longitudinal or helical-welded seams. Seams may be butt-welded, offset lap-welded or lap-welded.
2. Testing: Each cylinder with joint rings attached shall be hydrostatically tested to produce a circumferential stress at the bottom of the cylinder of at least 20,000 psi, but not more than 25,000 psi. If leaks develop during the hydrostatic test, the cylinder shall be repaired by welding and retested until all leaks have been eliminated. Outlet collars and wrappers, when required, shall be welded to cylinders prior to hydrostatic test. Cylinders heavier than No. 10 gauge, which may occasionally be required for special design situations, shall be tested to the pressure required for 10-gauge cylinder.

C. Joint Rings

1. Forming: The bell stock and special spigot shape shall be rolled and butt-welded to form round steel rings. Resistance or electric arc welding shall be used. Welds on gasket contact surfaces shall be ground smooth and flush with the adjacent surfaces. Joint rings shall be sized by expansion beyond their elastic limits. Joint rings shall be attached to the steel cylinders by electric arc welding. Minimum throat dimensions of the joint band fillet weld shall be equal to the thickness of the steel cylinder.
2. Coating: Prior to pipe shipment, exposed portions of the steel joint rings on the completed pipe shall be cleaned and protected with a shop-applied rust-inhibiting primer or metalized zinc coating.

D. Pipe Cores

1. Concrete: Fine aggregate, coarse aggregate, cement and cement replacement material, if specified, shall be batched by weighing. Water used in the mix shall be metered or weighed, and allowance shall be made for any free moisture present in the aggregates. All materials shall be mixed to a homogeneous mixture. No water may be added to the mix once the concrete has been discharged from the mixer. The temperature of the mix shall not be less than 40°F at the time of placement.
2. Casting: Pipe core shall be produced by the centrifugal, radial compaction or vertical casting method.
3. Curing: The pipe core shall be initially cured by accelerated or water curing methods, as described in the following paragraphs, or by a combination of these methods. Ambient curing of the pipe core shall be continued until the required compressive strength at time of prestressing is obtained. Concrete test cylinders made and cured in accordance with ASTM C31 and tested in accordance with ASTM C39 shall verify the required compressive strength.

    a. Accelerated Curing

        1) As soon as practical after completion of casting, the pipe core shall be enclosed within a suitable curing chamber that protects the pipe core from outside drafts. Enclosures shall allow full circulation around the inside and outside of the pipe core. Until four (4) hours after final placement of concrete, the ambient temperature within the enclosure shall not be less than 40°F and shall not be raised above 95°F by introducing heat. After four (4) hours, the temperature shall be increased at a rate not to exceed 40°F per hour, and thereafter maintained at a temperature between 90°F and 125°F for a minimum of eight (8) hours, except for the time required to remove the casting forms. The total curing period, consisting of the 4-hour delay period, the accelerated cure and the ambient cure, shall be sufficient to produce the concrete strength required by design. The ambient temperature in the curing chamber shall be thermostatically controlled and continuously recorded. Exposed concrete surfaces shall be kept continuously moist, either by maintaining an atmosphere in the curing chamber with a relative humidity of not less than 85 percent, by the presence of free water in contact with the exposed surfaces or by sealing exposed concrete surfaces with a concrete

curing compound suitable for potable water. The forms shall not be removed until at least six (6) hours after the start of curing. As soon as practicable after removal of the forms, the pipe core shall again be enclosed and curing continued.

2) For that part of the cure after removal of the forms, the curing facility shall provide a moist atmosphere about the entire pipe core with a relative humidity of not less than 85 percent.

b. Water Curing

1) Water curing may be substituted on a time-ratio basis of four (4) hours of water curing to one (1) hour of accelerated curing for any part of the cure after removal of the forms. The pipe core may be water cured by a system of perforated pipe, sprinklers, porous hose or other means that keeps the outside and inside of the pipe continuously moist.

E. Prestressing

1. After the concrete has attained the required compressive strength, the prestressing wire shall be helically wound around the core under measured and recorded tension at the design spacing. At the ends of the pipe, the wire shall be securely anchored to the pipe core. Anchorages of the wire at the ends of the core shall be capable of resisting a force equal to 75 percent of the specified minimum tensile strength of the wire.
2. Tension at each anchor shall not be less than half of the specified tension, and the tension shall increase to the full specified amount in the first wrap around the core adjacent to each anchor. Prior to prestressing, any voids of 0.375 inch in depth and diameter or greater and offsets greater than 0.125 inch on the exterior surface of the pipe core shall be repaired.
3. Wire splices shall be capable of withstanding a force equal to the specified minimum tensile strength of the wire.
4. During the circumferential prestressing operation, a portland cement slurry shall be applied to coat the wire bearing surface. The slurry shall consist of one (1) sack of portland cement to not more than eight (8) gallons of water. A retarder may be used in the mix.

F. Cement Mortar Coating

1. Batching: Fine aggregate and cement for the cement-mortar coating shall be batched by weighing, and all water used in the mix shall be metered or weighed. All materials shall be mixed thoroughly. The moisture content of the mortar mix shall be a minimum of seven (7) percent of the total dry weight. The temperature of the mortar mix shall not be less than 40°F at the time of placement.
2. Applying:

a. Immediately prior to application of the cement mortar coating, a slurry consisting of one (1) sack of portland cement to not more than eight (8) gallons of water shall be applied uniformly over the wire wrapped surface of the core at a rate of not less than one (1) gallon per 100 square feet. A retarder may be used in the mix.

b. The cement mortar shall be mechanically impacted against the pipe to form a

coating of the required thickness. The finished coating shall be dense and firm throughout and shall be in intimate contact with the core and the prestressing wire.

3. Curing: The cement mortar coating shall be cured by accelerated or water curing methods, as described in the following paragraphs, or by a combination of these methods.

   a. Accelerated Curing: As soon as practical after completion of coating, the pipe shall be enclosed within a suitable curing chamber that will protect the pipe from outside drafts. Enclosures shall allow full circulation around the outside of the coated pipe. Until one (1) to four (4) hours after placement of the cement mortar, the ambient temperature within the enclosure shall not be less than 40°F; and shall not be raised above 95°F by introducing heat. After the 1- to 4-hour delay period, the temperature shall then be increased at a rate not to exceed 40°F per hour, and thereafter maintained at a temperature between 90°F and 125°F for a minimum period of 12 hours. The 1- to 4-hour delay period to attain initial set may be included as part of the 12 hours. The ambient temperature in the curing chamber shall be thermostatically controlled and continuously recorded. The curing facility shall provide a moist atmosphere about the outside of the pipe with a relative humidity not less than 85 percent.
   b. Water Curing: After six (6) hours of accelerated cure, water curing may be substituted on a time-ratio basis of eight (8) hours of water curing to one (1) hour of accelerated curing. The coating shall be kept moist by a system of intermittent sprinklers, porous hose or other approved means that keeps the coating moist for a minimum period of four (4) days. Water curing may be used only if the ambient temperature is above 40°F. The curing period shall be extended one (1) hour for each hour in the first 24 hours, during which the ambient temperature is less than 50°F.

G. Testing: For completed pipe in which the cylinders have already been tested in accordance with Section 2.4.B.2, additional testing shall not be required.

H. Repairing: Repairs to damaged pipe may be made, so long as they are compatible with the method of pipe making. All repairs shall be subject to approval of the Engineer.

I. Marking: Each length of standard pipe and special pipe shall have the manufacturer's identification marks and date of casting plainly marked inside one end of the pipe. Each pipe shall be sufficiently identified to show its proper location in the pipeline by reference to layout drawings or schedules. Beveled pipe shall be marked at the spigot end to show the degree of bevel and the point of maximum pipe length.

2.4 SOURCE QUALITY CONTROL

A. Owner Inspection: Make completed pipe joints available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed.

B. Owner Witnessing: Allow witnessing of factory inspections and test at manufacturer's test facility. Notify Owner at least seven days before inspections and tests are scheduled.

C. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection and Acceptance

1. Minor imperfections shall be repaired in the field in accordance with the manufacturer's procedures.
2. Damaged pipe, fittings or specials shall be repaired in the field if permitted by the Engineer or returned to the pipe plant for repairs or replacement. All repairs shall be in accordance with the manufacturer's procedures. All materials used for repair shall be approved by the Engineer and pipe manufacturer. Repairs shall be carefully inspected before installation of the pipe.
3. Damaged pipe discovered after installation shall be repaired in place if permitted by the Engineer and pipe manufacturer. All repairs shall be in accordance with the manufacturer's procedures. If in-place repairs are not permitted, the damaged pipe shall be removed and replaced.

B. Onsite Services by Pipe Manufacturer's Field Service Representative

1. Installation of the pipeline shall be performed in accordance with specified standards and manufacturer's recommendations. The Contractor shall ensure the manufacturer's Field Service Representative will be onsite to provide the following services:

a. Perform initial pipe pre-installation training
b. Evaluate problems and provide advice during pipe installation

3.2 PREPARATION

A. Cleaning: All pipe, fittings and specials shall be thoroughly cleaned before installation and shall be kept clean until used in the work. The pipe interior shall be maintained dry and broom clean throughout the construction period.

3.3 INSTALLATION

A. General

1. Prestressed concrete cylinder pipe and fittings shall be installed in accordance with

requirements of AWWA M9, except as otherwise specified herein. A firm and even bearing throughout the length of the pipe shall be provided by digging bells holes at each joint and by tamping select fill at the side of the pipe to the springline. BLOCKING WILL NOT BE PERMITTED.

B. Pipe Installation

1. Installation of pipe, fittings and specials shall conform to the lines and grades shown on the drawings.
2. All pipe shall be sound and clean before laying.
3. When installation is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other means approved by the Engineer to prevent unauthorized entrance of people, animals, dirt, debris or water into the pipeline already installed.

C. Joint Deflections

1. Good alignment shall be preserved in laying.
2. Angular changes in pipe alignment shall be formed by deflecting joints, straight pipe with beveled ends, fittings or a combination of these techniques. Joints may be deflected to form curves, to span angle points or to correct alignment.
3. The deflections at joints shall not exceed 75 percent of that recommended by the manufacturers.
4. Fittings, in addition to those shown on the drawings, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench.

D. Jointing

1. Gasket, gasket groove and bell sealing surfaces shall be cleaned and lubricated with a vegetable lubricant furnished by the pipe manufacturer. The lubricant shall be approved by the Engineer for use in potable water and shall be harmless to the gasket. Pipe is normally installed with bell ends facing the direction of laying. If necessary, pipe may be laid with spigot ends looking ahead when approved by the Engineer.
2. The method of pipe jointing shall be in accordance with AWWA Manual M9 and the pipe manufacturer's recommendations. Once the joint is made, the position of the gasket in the spigot ring groove shall be checked with a feeler gauge provided by the pipe manufacturer. If the gasket is found to be displaced, the joint shall be removed, a new gasket installed, the joint re-laid and the gasket position rechecked.

E. Joint Protection

1. Interior

a. Exposed surfaces of steel joint rings shall be protected by methods compatible with the pipe manufacturer's production processes and in accordance with AWWA Manual M9.
b. Pack interior joints of pipe 30-in in diameter and larger with mortar after backfilling is completed. Mortar grout shall be employed, consisting of 1 part by volume of Portland cement to 1-1/2 parts well graded coarse concrete sand meeting

the requirements of ASTM C33 and sufficient water to make a stiff mortar suitable for overhead work. The mixture shall have a dry, crumbly consistency and shall be pushed into place and troweled to make a smooth joint. Refer to AWWA M9 for interior grouting of other sizes of pipe.

2. Exterior

a. The grout band (diaper) shall consist of a Typar synthetic fabric layer and a layer of closed cell foam. These layers are sewn together along with a pair of steel bands at each edge which are used to secure the diaper to the pipe exterior. Only grout bands supplied by the pipe manufacturer shall be used. A stretching tool is used to tighten the steel bands. Once the steel bands are pulled tight, a steel clip is crimped around the bands to hold them in position. It is important that the grout band be carefully placed against the exterior surface of the pipe to ensure that it is flush with no gaps or gathers. The closed cell foam surface is to be placed against the pipe exterior.

b. The wet grout shall flow down to the bottom of the grout band and begin to bulge it out. Bedding material (or sandbags) shall be placed directly under the grout band at the bottom to support the weight of the wet grout. Care shall be taken not to push excessive amounts of bedding material under the grout band such that the grout band is pushed up into the joint recess impeding the flow of wet grout.

c. The grout shall be mixed using one (1) part ASTM C150 Type I or Type II Portland cement to not more than two (2) parts clean sand with sufficient water to achieve a pourable consistency. The grout should look and pour like a thick cream. The mixed grout shall be poured carefully into the gap at the top of the diaper. As the pouring proceeds, the workers shall inspect the grout band around the joint periphery to ensure the grout is flowing all around. Once the grout band is full and wet grout is puddling at the gap at the top, the workers shall apply a stiffer mix the consistency of wet brick mortar to fill the gap at the top ensuring all steel components of the joint are properly covered.

F. Have on hand a sufficient supply of assorted short pipe lengths, adaptors and any other fittings necessary to prevent delays in pipe laying.

G. Restrained joints shall be installed to the limits indicated on the drawings or as directed by the Engineer in accordance with applicable provisions of the above.

3.4 FIELD QUALITY CONTROL

A. Inspect for dimensions and elevations for buried pipe.

B. Perform hydrostatic tests and provide bulkheads as needed for.

3.5 CLEANING

A. At the conclusion of installation and prior to post-construction hydrostatic testing, the pipeline shall be flushed with water or other method approved by the Engineer to remove all dirt, stones

and debris which may have entered the pipeline during construction.

3.6 DEMONSTRATION

A. Testing

1. The completed pipeline (or completed sections of the pipeline) shall be bulk headed, filled with water and pressure tested to 120 percent of the internal working pressure as measured at the low point of the pipeline. After the line is filled with water, and prior to pressure testing, the pipe shall be allowed to soak under low pressure for a minimum of 48 hours so the pipe walls can absorb water and the temperature can stabilize. When filling the line, the Contractor shall properly bleed off any trapped air to avoid adversely affecting the leakage test results.
2. During hydrostatic testing, the Contractor shall use a calibrated meter or other device approved by the Engineer to accurately measure the quantity of water necessary to maintain the test pressure on the gauge. The pipeline will be accepted when the measured quantity is less than ten (10) gallons per inch of diameter per mile of pipeline per 24-hour test period.
3. Visible leaks shall be repaired using a procedure approved by the Engineer regardless of measured leakage.

3.7 PROTECTION

A. Pipe Care

1. Pipe shall be handled carefully during unloading and stored in a manner designed to prevent damage to any part of the pipe, fittings, specials or coatings.

B. Live Loads

1. The Contractor shall regulate and control equipment and construction operations such that live loads on the pipe do not exceed the design loads for the pipe. If longitudinal cracks caused by construction equipment or other loads exceed those allowed by AWWA C304, the pipe shall be repaired in accordance with the manufacturer's procedures as approved by the Engineer.

END OF SECTION 33 05 39.13