SECTION 1403

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

1403.0100 GENERAL

1403.0101 Description of Work. The work under this section shall consist of furnishing and installing high density polyethylene (HDPE) pipe and fittings. The manufacturer shall be listed in the approved manufacturers list in Appendix A to these Standard Specifications. All materials must be in compliance with the plans and special specifications.

1403.0102 Quality Assurance

(A) HDPE pipe and fitting assemblies shall be manufactured from the product of one approved manufacturer. Mixing of pipe and fittings from more than one manufacturer will not be permitted.

(B) Pipe and fitting joints shall be heat fused by a qualified installer who has been trained by an approved manufacturer's representative, in accordance with the manufacturer's recommended fusion procedures. Training must have occurred in the previous 12 months, or experience performing heat fusion on HDPE pipe and fittings within the previous 12 months. Submittal of training certification to the Engineer must be made prior to beginning construction. Bends, tees, and associated fittings may be HDPE or mechanical joint ductile iron pipe or cast iron with restraint features, as specified herein and listed on the approved manufacturers list.

1403.0104 Delivery, Storage and Handling. All materials delivered to the job site shall be new, free from defects, and marked to identify the material and class. All precautions shall be taken to prevent damage or contamination to pipe and other materials during shipment. The Contractor and Engineer shall examine all materials before unloading and installation.

Compatibility of all pipe and fittings shall be verified prior to installation. HDPE pipe shall not be dropped, rolled or pushed from any height. Stored pipe shall be protected from long exposure to ultraviolet light. Any fitting or pipe section containing scratches, dents, or marks exceeding ten percent of the calculated wall thickness shall be rejected. Rejection will be at the sole discretion of the Engineer.

1403.0200 PRODUCTS.

1403.0201 Materials.

(A) High Density Polyethylene (HDPE) Pipe. HDPE pipe shall be manufactured from extra high molecular weight polyethylene pipe materials meeting the requirements of ASTM D3350-96. The pipe shall meet the requirements of cell classification PE345444C standard PE code designation PE3408 as defined by ASTM D3350-96 and D3350. The manufacturer shall certify that the material meeting this specification has exceeded 5,000 hours without failure when tested under ASTM F 1248, and has a hydrostatic design basis of 1,600 psi at 73°F and 800 psi at 140°F when tested under ASTM D 2837.

The design pressure of the pipe shall be defined in accordance with ASTM D 3035 and F 714. The pipe shall have a controlled outside diameter and shall be produced to an SDR/DR ratio no larger than 11.

(B) HDPE Fittings. The fittings shall be manufactured using the same pressure rating as the pipe. Fittings shall be manufactured to standardized dimensions and shall be compatible with Tucson Water standard fittings, valves, tees, service saddles, curb stops, and meter stops. Heat fusion fittings shall be manufactured from the same material as the extruded pipe, shall be rated for pressure service at least equal to that of the pipe, and shall have outlets manufactured to the same DR as the pipe. Molded fittings shall be manufactured to ASTM D 3261 and socket fittings to ASTM D 2683. Connections to the existing water system other than HDPE pipe shall be restrained mechanical joint fittings, with stiffeners, or inserts if recommended by the manufacturer.

(C) Markings. The manufacturer shall apply production data markings as specified herein to the outside surface of the pipe, running longitudinally, repeated continuously, using a permanent non-toxic lettering. Required production data shall include pipe diameter and designation (e.g., 2" IPS OD), material code identification PE3408, dimension ration DR 9 or 11, pressure class (at least 150 psi), AWWA designation AWWA C-901 or 906, and potable water designation NSF-pw. HDPE pipe used for potable water will have a blue stripe. HDPE used for reclaimed water will have a purple stripe. Striping will be continuous along the entire length of the pipe.

1403.0300 EXECUTION

1403.0301 General. Contractor shall inspect all piping prior to installation to assure that pipe is free from defects in material and workmanship. The compatibility of all pipe and fittings shall be verified. Pipe fittings and accessories that are cracked, damaged, not identified, or in poor condition shall be rejected. Any pipe section or fitting containing significant scratches, dents, or marks shall be deemed unusable and rejected, or the suspect section removed from service. Any fitting or pipe section containing scratches, dents, or marks exceeding ten percent of the calculated wall thickness shall be rejected. Any substantial scratch in the opinion of the Engineer may be cause for rejection. Rejection will be at the sole discretion of the Engineer.

The Inspector shall have free access to all joints and test joints for determining the suitability of the joining procedure. Where construction restrictions limit inspection of joints, the Engineer may have the person joining the pipe and/or fittings perform a test joint in the presence of the Engineer, or have the joint in question tested. The Engineer shall determine the method of testing: either visual inspection, bent strap testing, or ultrasonic testing, per DOT CFR 49, Part 192.286 (b)(ii) or (b)(iii).

1403.0302 Installation.

(A) Joining. The pipe and fittings shall be heat fused together to create a homogeneous joint. Joining shall be accomplished as determined by the Engineer in accordance with the manufacturer's heat fusion recommendations. Joints shall not be of the solvent weld type.

Each person making heat fusion joints shall demonstrate proficiency by making joints and testing the trial fusion by bent strap testing or ultrasonic testing. Trial joints shall be allowed to cool completely before testing and shall not fail at the joint.

During construction, the first fusion of the day shall be a trial fusion which shall be allowed to cool completely and destructively tested as directed by the Engineer. If the trial fusion fails, additional trial fusions shall be made and tested until successful fusions are completed. The procedure used to join the successful trial fusion shall be used for the balance of the day's work, provided the procedure is within the limitations recommended by the manufacturer. The Engineer shall have the authority to disallow any installer from completing heat fusion of HDPE pipe if that installer has consecutively failed trial joints. Any person deemed unqualified by the Engineer will require training as specified in 1403.0102 before being permitted to heat fuse HDPE pipe.

During construction, the Contractor shall report any occurrence of potential soil contamination in the vicinity of the pipe trench to the Engineer immediately. Work shall be stopped until the contamination is remedied.

(B) Placing and Laying. All HDPE pipe shall be installed to minimize shear and tensile stresses. Pipe bedding and shading shall be sand. Pipe installation, bedding, and backfill shall be in accordance with Section 0209. The minimum radius of field bends shall be ten pipe diameters for pipe twenty-four inches and larger. Pipe bends shall be anchored by thrust blocks so that thermal unit changes will take place in the elasticity of the material. To prevent collapse of the pipe when vacuum and soil loads are applied, external pressure from depth of bury shall not exceed 41 psi.

(C) Field Testing. The Contractor shall perform hydrostatic leakage tests on all HDPE pipe in accordance with the non-monitored makeup water test.

Monitored Make-up Water Test

The test procedure consists of initial expansion, and test phases. During the initial expansion phase, the test section is pressurized to the test pressure, and enough make-up liquid is added each hour for three (3) hours to return to test pressure.

The test phase follows immediately, and may be one (1), two (2), or three (3) hours. At the end of the test time, the test section is returned to test pressure by adding a measured amount of liquid. If the amount of make-up liquid added does not exceed Table 1 values, leakage is not indicated.

Test Duration

For any test pressure from 1 to 1-1/2 times the system operating design pressure, the total test time including initial pressurization, initial expansion, and time at test pressure, must not exceed eight (8) hours. If the test is not completed due to leakage, equipment failure, etc., depressurize the test section, then allow it to "relax" for at least eight (8) hours before bringing the test section up to test pressure again.

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Table 1 Test Phase Make-up Amount

Nominal Pipe Size (in.)	Gallons/100 ft. of Pipe		
	1 Hour Test	2 Hour Test	3 Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.5
26	5.0	10.0	15.0
28	5.5	11.1	16.8
30	6.3	12.7	19.2
32	7.0	14.3	21.5
34	7.0	16.2	24.3
36	9.0	18.0	27.0