

DATE: December 12, 2017

TO: Paul Zachary, Engineering Services Department Director

VIA: Henry Som de Cerff, Design Engineering Manager

FROM: Ryan McKaskle, Lead Engineer

SUBJECT: **Changes to Division II & III of the Standard Specifications and Standard Details**

The following items were presented at the December 13, 2016 Specification Committee

- Modify Material Specifications & Sections 203, 207, 307, 301, 310, 325,
- Modify Standard Details 304, 311, 501, 501A, 502, 502A, 503 & 504
- Add Material Specifications & Sections 207A, 309A, 310A, 311A & 312A
- Add Standard Details 316, 317, 318, 319, 320 & 321
- Delete Standard Detail 305

The Specification Review Committee recommends and asks the Engineering Services Director to approve updates to the attached Standard Specifications and Standard Details.

Please call me at 918-596-9566 if you have any questions.

Thank you

APPROVED:

Paul Zachary, City Engineer

Date

Cc: Engineering Services Department Specification Review Committee

DIVISION II
MATERIAL SPECIFICATIONS
APPROVED FITTINGS MANUFACTURERS

Restrained Joint Systems

ROMAC Alpha & Alpha XL (DIP, PVC, HDPE)
EBAA Megalug (DIP,PVC)
Ford Meter Box Uni-Flange (DIP,PVC)
Star StarGrip (DIP,PVC)
SIP Industries EZ GRIP (DIP, PVC)
Sigma Corporation ONE-LOK Series (DIP, PVC)
American Flex-Ring (DIP)
Clow TUFGRIP (DIP)
Smith-Blair CAM-LOCK (PVC)
Price Snap Ring & Harness Joint (Conc)
Hanson Snap Ring & Harness Joint (Conc)
Northwest weld (Steel)
Hanson weld (Steel)
USPipe TR Flex (DIP grav sanit, water)
Griffin SNAP-LOK (DIP grav sanit, water)
McWane THRUST-LOCK (DIP grav sanit, water)

203.3 COATING, LINING AND POLYETHYLENE WRAP

203.3.1 Cast iron and ductile iron pipe and fittings shall be bituminous coated outside and cement-mortar lined inside with seal coat in accordance with American National Standard for Cement Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings for Water, ANSI/AWWA C104/A21.4.

203.3.2 All ductile iron and cast iron pipe and fittings shall be encased with polyethylene tube in accordance with AWWA C105, American National Standard for Polyethylene Encasement for Ductile Iron Piping for water and other liquids referred hereafter as polywrap. Polywrap shall be manufactured from virgin polyethylene material conforming to the following:

203.3.2.1 Raw material requirements, per ASTM D4976

- Group: 2 (Linear)
- Density: 0.910 to 0.935 g/cm³
- Dielectric strength: Volume resistivity, 1015 ohm-cm, minimum

203.3.2.2 Physical properties of finished film.

- Tensile strength: 3,600 psi (24.8 MPa) for an 8-mil (200- μ m) minimum thickness, or 28.8 lbf/in. width (50.4 N/cm width), minimum in machine and transverse direction (ASTM D882)
- Elongation: 700 percent, minimum in machine and transverse direction (ASTM D882)
- Dielectric strength: 800 V/mil (31.8 V/ μ m) thickness, minimum (ASTM D149)
- Impact resistance: 600 g, minimum (ASTM D1709 Method B)
- Propagation tear resistance: 2,550 gf (grams force), minimum in machine and transverse direction (ASTM D1922)

203.3.2.3 Thickness. Linear low-density polyethylene film shall have a minimum thickness of 0.008 in. (8 mil or 200 μ m).

203.3.2.4 Color. Polywrap may be supplied in its natural color, white, black, or weather-resistant black containing not less than 2 percent carbon black with a particle diameter of 90 nm or less. A minimum 2 percent of a hindered amine ultraviolet inhibitor is required for all films other than the weather-resistant black film with carbon black. Where other colors are specified for purposes of identification, the pigmentation shall not contain any regulated substances.

203.3.2.5 Tape. The polywrap shall be secured as specified below with 2-inch wide pressure sensitive tape not less than 10 mils thick. This flexible tape shall consist of a polyethylene or polyvinyl chloride backing with a synthetic elastomeric adhesive film comprised of butyl rubber. Tape shall remain flexible over a wide range of temperatures, with tensile strength and elongation properties in conformance with ASTM D1000.

The minimum tube size for each pipe diameter shall be per Table 1.

Table 1 Polyethylene tube and sheet sizes for push-on joint pipe*

NOMINAL PIPE SIZES	PUSH-ON JOINT FLAT TUBE WIDTH	MECHANICAL JOINT FLAT TUBE WIDTH
3 in.	16 in.	16 in.
4 in.	16 in.	16 in.
6 in.	16 in.	20 in.
8 in.	20 in.	24 in.
10 in.	24 in.	27 in.
12 in.	27 in.	30 in.
14 in.	30 in.	34 in.
16 in.	34 in.	37 in.
18 in.	37 in.	41 in.
20 in.	54 in.	54 in.
24 in.	54 in.	54 in.
30 in.	67 in.	67 in.
36 in.	84 in.	84 in.
42 in.	84 in.	84 in.
48 in.	96 in.	96 in.
54 in.	108 in.	108 in.
60 in.	108 in.	108 in.
64 in.	121 in.	121 in.

*These wrap sizes should work with most push-on joint pipe and fitting bell sizes. Where bell or fitting circumferences are larger than the tube sizes shown, a larger tube to effectively cover these joints should be ordered.

PART 207 - POLYVINYL CHLORIDE (PVC) PIPE, WATER SERVICE

- 207.1 Where polyvinyl chloride (PVC) pipe four (4) inches in diameter through twelve (12) inches in diameter is specified or required, it shall conform to and be tested in accordance with AWWA C900, "AWWA STANDARD for POLYVINYL CHLORIDE (PVC) PRESSURE PIPE, 4 IN. THROUGH 12 IN., FOR WATER", as herein modified. PVC water pipe shall be approved by the Underwriters Laboratory Sanitation Foundation Testing Laboratory for potable water pipe. Polyvinyl chloride water pipe shall be **restricted from use within arterial street right of way.**

307.1 The work under this item shall include furnishing, delivery, placing, and jointing of Ductile Iron pipe in the trench in specific conformity with the lines and levels given. All Ductile Iron pipe shall be wrapped with a loose fitting, slip-on polywrap. The polywrap shall be slipped over the end of the pipe length that has been raised above the ground at the trench side.

The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. With the pipe suspended from the center the tube shall be slipped over the spigot end and bunched up between the point of support and the spigot end. After the pipe is installed into the bell of the adjacent pipe the pipe shall be lowered to the trench bottom and the supporting sling removed from the center of the pipe. The pipe shall then be raised at the bell end enough to allow the tube to be slipped along the full length of the barrel with enough left at each end to overlap the adjoining pipe about 1 foot. A shallow bell hole must be made at each joint to facilitate installation of the polywrap.

Pull the bunched-up polywrap from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. Then slip the end of the polywrap from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Tape it in place.

The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe, and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.

Repair any rips, punctures or other damage to the tube with the adhesive tape or pieces of tube material secured with tape. Adhesive tape shall PVC Tape, IAPMO/UPC certified for AWWA & plumbing applications.

Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.

Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

For all pipe, the American National Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances, AWWA C-600 shall govern the installation as applicable. The method of bedding shall be as shown on the attached Standard Detail for Thrust Blocks and Trench Conditions, and Standard Detail for Pavement Removal and Replacements as applicable.

301.4 PAYMENT: Payment for this item shall be made at the unit price bid per **square yard**. The contractor shall restore all disturbed areas to a condition equal to or better than the existing improvements. **Limits of disturbance shall not exceed 9-feet centered on the waterline (4.5-feet either side of centerline). Any disturbance outside this area shall be restored at the contractor's expense. Bores, fittings, streets, driveways, or specials, shall be paid under other items of work.** No additional payment shall be made for alterations of utility mains, service lines, or appurtenances, unless specifically provided for elsewhere in the Contract Documents.

PART 310 - LOCATOR WIRE AND DETECTABLE MARKING TAPE

310.3 Detectable Mylar Tape shall be buried above PVC water lines at a depth of 18-inches below the surface.

325.5 PAYMENT: Payment for Sod Replacement or Hydromulch Seeding will be made at the unit price bid per square yard and shall include all necessary top soil replacement, fertilizing, watering, and maintenance. Limits of disturbance shall not exceed 9-feet centered on the waterline (4.5-feet either side of centerline). Any disturbance outside this area shall be restored at the contractor's expense.

PART 207A – HIGH DENSITY POLYETHYLENE (HDPE) PIPE, WATER SERVICE

207A.1 Where high density polyethylene (HDPE) pipe four (4) inches through 63 inches in diameter is specified or required, it shall conform to and be tested in accordance with AWWA C906 “POLYETHYLENE (PE) PRESSURE PIPE AND FITTINGS, 4 INCH THROUGH 63 INCH, FOR WATER DISTRIBUTION AND TRANSMISSION” as herein modified. HDPE water pipe shall be approved by the Underwriters Laboratory Sanitation Foundation Testing Laboratory for potable water pipe. HDPE water pipe shall be restricted from use within arterial street right of way.

207A.2 Polyethylene compounds utilized in the manufacture of products furnished under this specification shall be listed in PPI TR-4, have a grade of PE47 with a minimum cell classification of PE 445574C for PE4710 materials, as defined in ASTM D3350. In conformance with AWWA C906, they shall have a PPI recommended Hydrostatic Design Basis (HDB) of 1600 psi (PE4710) at a temperature of 73.4°F (23°C). The materials shall meet the following nominal physical property requirements:

PROPERTY	TEST METHOD ⁽¹⁾	NOMINAL VALUE
Material Designation	PPI/ASTM	PE4710
Cell Classification	D3350	445574C
Density, Natural	D1505	0.947 gm/cc
Density, Black	D1505	0.956 gm/cc
Melt Index (190°C/2.16 kg)	D1238	<0.15 gm/10min
Flow Rate (190°C/21.6 kg)	D1238	8.5 gm/10 min
Tensile Strength @ Ultimate	D638	5,000 psi
Tensile Strength @ Yield	D638	3,500 psi
Ultimate Elongation	D638	>800%
Flexural Modulus, 2% Secant	D790	110,000 – 160,000 psi
Environmental Stress Crack Resistance (ESCR)		
F ₀ , Condition C	D1693	>10,000 hrs.
PENT	F1473	>500 hrs.
Brittleness Temperature	D746	<-180°F
Hardness, Shore D	D2240	64
Vicat Softening Temperature	D1525	255°F
Izod Impact Strength, Notched	D256	7 ft-lb _f /in
Modulus of Elasticity (short term)	D638	130,000 psi
Modulus of Elasticity (long term)	D638	32,500 psi
Thermal Expansion Coefficient	D696	8.0 x 10 ⁵ in/in/°F
Average Molecular Weight	GPC	330,000
PPI Hydrostatic Design Basis: (As listed in PPI TR-4)	D2837	1,600 psi @ 73.4°F 1000 psi @ 140°F

(1) Test procedures are ASTM unless otherwise specified. (PPI = Plastics Pipe Institute, and GPC = Gel Permeation Chromatography.)

207A.3 HDPE pipe shall have a Diameter Ratio (DR) of 11, shall be Ductile Iron Pipe Size (DIPS) as indicated in the chart below, and shall be certified for conformance with NSF/ANSI Standard 61. A DR greater than 11 shall not be permitted.

DIP/PVC Size (in)	HDPE size (in)
6	8 DIPS
8	10 DIPS
10	12 DIPS
12	14 DIPS

207A.4 The Pressure Class of the PE pipe and PE fittings shall be specified on the basis of the Working Pressure Rating of the water system as defined in AWWA C906. Recurring positive pressure surges of up to one half of the pipe's nominal pressure class and occasional pressure surges of up to 100% of the pipe's nominal pressure class may be ignored due to the fatigue endurance of the polyethylene materials. For PE 4710, the net pressure capability shall be the working pressure rating (WPR) @ 73°F as follows:

DR	WPR (psi)	WPR + Surge (psi)	Hydrotest (psi)	Nominal 60 sec. Burst (psi)
11.0	200	300	300	800

207A.5 Polyethylene fittings, including custom fabrications, shall have the same internal pressure rating as the mating pipe. The use of derated fittings shall not be permitted. At the point of fusion, the wall thickness and outside diameter of the fitting shall be in accordance with AWWA C-906 for the same pipe size.

207A.6 All HDPE taps for water service line shall be made with a HDPE fusion tapping saddle Poly-Cam Series 415 or 575 (HDPE) or approved equal.

207A.7 Permanent identification of piping shall be provided by co-extruding multiple (minimum 4) equally spaced blue color stripes into the pipe outside surface or by solid blue colored pipe shell. The identification material shall be the same material as the pipe material described herein, except for the blue color. Plain Black HDPE Pipe without color markings may not be used in the City of Tulsa Distribution System.

ASTM, AWWA, NSF and CSA standards require that markings on pipe and tubing be present at frequent intervals – generally not less than every 5 feet – and that they include at least the following items of information:

- The nominal pipe or tubing size (e.g., 1-inch);
- The type of PE material from which the pipe is made (e.g., PE 4710);
- The pipe or tubing dimension ratio or the pipe pressure rating or pressure class for 73° F water, or both;
- The standard against which the pipe has been made and tested;
- The manufacturer's name or trademark;
- Production record coding the place and time of manufacture; and
- The seal or mark of the certification agency that has determined the suitability of the pipe for potable water service.

PART 309A – HIGH DENSITY POLYETHYLENE (HDPE) PIPE, WATER SERVICE

- 309A.1 When HDPE pipe is delivered to the jobsite it shall not be exposed to sunlight for more than three (3) weeks. HDPE pipe exposed to sunlight for more than three (3) weeks shall be covered with an opaque protective covering. The pipe shall be left stacked and no more pipe than can be installed in one day shall be strung along the jobsite.
- 309A.2 Pipe and fittings shall be joined by one of the following types of thermal fusion per the Manufacturer's recommended procedures: Butt fusion, Saddle fusion or Socket fusion. Butt fusions performed between pipe ends or pipe ends and fitting outlets shall be within the following allowable wall mismatches:
- a. Two (2) DR difference between pipe and fitting diameters 6" and smaller.
 - b. One (1) DR difference for above a 6" and through 18".
 - c. No difference for diameters above 18".

The difference in DR is determined from the following DR values: 7.3, 9, and 11.

- 309A.3 Polyethylene pipe and fittings may be joined together or to other materials through the use of electrofusion fittings, flange adapters with back-up rings, mechanical couplings designed for connecting polyethylene pipe and fittings to itself or to another material, or MJ adapters. The Manufacturer of the joining device shall be consulted for proper installation procedures.
- 309A.4 Polyethylene pipe and fittings joined together through the use of a hydraulically operated heat butt fusion machine, shall utilize a data recording device per ASTM F3124 – STANDARD PRACTICE FOR DATA RECORDING THE PROCEDURE USED TO PRODUCE HEAT BUTT FUSION JOINTS IN PLASTIC PIPING SYSTEMS OR FITTINGS. Each HDPE joint shall be traceable to the fusion operator and equipment. Electrofusion reports of each weld shall be appropriately identified and provided to City of Tulsa Inspector. The reports shall include, as a minimum, the fusion date, time, ambient temperature, fitting type and size, user ID, and the manufacturer of the part.
- 309A.5 The Contractor shall be responsible for ensuring all personnel operating heat fusion equipment are qualified Heat Fusion Equipment Operators in accordance with ASTM F3190-16 – STANDARD PRACTICE FOR HEAT FUSION EQUIPMENT (HFE) OPERATOR QUALIFICATION ON POLYETHYLENE (PE) AND POLYAMIDE (PA) PIPE AND FITTINGS. All polyethylene joints shall be thermally butt fused by an HFE Operator. The HFE Operators Card shall be submitted at the Pre-Construction Conference and provided at the request of the Engineer. Certification by a distributor shall not be an acceptable substitute.
- 309A.6 **PAYMENT:** Payment for this item shall be made at the unit price bid per linear foot of pipe of the type specified in the Proposal, and placed as shown on the Drawings. Total footage shall be the actual horizontal measurement along the centerline of the pipe. No additional payment shall be made for vertical pipe or fittings or specials included as pipe, or for concrete blocking. Payment for any HDPE pipe designated "restrained joint" shall include cost of all components to restrain joints of pipe.

PART 310A - LOCATOR WIRE AND DETECTABLE MARKING TAPE FOR HDPE

- 310A.1 A Number 8 bare copper conductor wire or Number 12 copper-clad steel (CCS) wire, 21% conductivity, for the purpose of locating HDPE pipe shall be buried along the top of the pipe, and connected at each end to a fire hydrant by Cadweld Brazing just above the ground
- 310A.2 Detectable Mylar marking tape for location of HDPE water pipe shall be required in all areas where HDPE water pipe is buried. Detectable Mylar marking tape shall be 2-inches wide, Blue in color with a continuous black lettered imprint stating "Caution: Water Line Below". Tape shall be equal to Lineguard Tape III as manufactures by Lineguard, Inc. of Wheaton, Illinois.
- 310A.3 Detectable Mylar Tape shall be buried above HDPE water lines at a depth of 18-inches below the surface.
- 310A.4 Payment for tape and wire shall be included with unit price payment for HDPE pipe.

PART 311 - TAPPING OF PVC PIPE FOR SERVICE CONNECTIONS

- 311A.1 Standard water service connections shall be made by using side fusion or electro fusion saddles per standard drawings. The saddles shall be provided with factory installed female threaded insert Brass Alloy C360 AWWA C 800 for standard corporation stop threads. Bushings must match the corporation stops. Direct tapping of HDPE water pipe will not be allowed.

PART 312A – FITTINGS (HDPE)

312A.1 The work under this item shall include all of the requirements specified under the item of pipe, in that “pipe” is understood to also mean ‘bends”, tees, sleeves, outlet assemblies, and other specified fittings.” All HDPE fittings shall be rated at the same pressure of the connecting pipe. Derated fittings shall not be permitted.

312A.2 PAYMENT: Payment for this item at the unit price bid per fitting, of the type specified in the Proposal, and placed as shown on the drawings. Only fittings specifically noted in the Proposal are included in this item. No additional payment shall be made for excavation, backfilling, or concrete blocking.

Payment for any fittings designated as “restrained”: shall include cost of all components to restrain joints of fittings.