



**STANDARD SPECIFICATIONS FOR
POLYPROPYLENE STORM UTILITIES CONSTRUCTION**

(DUAL WALL PIPE 12"-60" DIAMETER)

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PART 1 — GENERAL

1.1 Reference Standards

- A. AASHTO HB Section 30 – Thermoplastic Pipe
- B. AASHTO T-341 – Determination of Compression Capacity for profile Wall pipe by Stub Compression Loading
- C. AASHTO R-16 – Regulatory information Used in AASHTO Tests
- D. AASHTO M330 – Polypropylene Pipe 300- 1500-mm (12- to 60-in.) Diameter
- E. ASTM D2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- F. ASTM D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- G. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- H. ASTM F1417 – Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
- I. ASTM F2487 – Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene Pipelines
- J. ASTM F2764 – 6 to 30 in. (152 to 762 mm) Polypropylene (PP) Corrugated Double Wall Pipe And Triple Wall pipe.
- K. ASTM F2881 – 12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications

1.2 Definitions

- A. PP – Polypropylene Pipe
- B. Piping System: All products associated with the drainage system including but not limited to pipe, fittings, drainage structures, geotextile, best management practice products and storage systems.

1.3 Performance Requirements

All pipe supplied shall meet the minimum joint performance requirements as defined herein and as further defined in the joint performance requirements of this specification.

- A. Watertight Gravity-Flow, Non-Pressure, Drainage-Piping shall be able pass a 10.8 psi (104kPa), gage, laboratory pressure test for 10 minutes with no visible leaks at the joint or pipe wall. Piping shall pass the same tests as above but with an axial joint misalignment of not less than 1 degree.

1.4 Submittals

The following shall be submitted by contractor:

- A. Product Data for the following:
 - 1. Pipe and Fittings
 - a. Product specifications
 - b. Installation procedures
- B. Products submitted as approved equal product must contain a signed letter from an executive officer of the manufacturer stating product is equivalent to all applicable requirements of this specification, to be reviewed by the City, and shall include all items listed in section 1.4 of this specification.
- C. Details of fittings and specials shall be furnished for approval by ENGINEER. Unless otherwise specified, CONTRACTOR shall submit to ENGINEER for approval SHOP DRAWINGS showing the exact dimension of the joints including the permissible tolerances for each size of pipe being furnished and the size, type and locations of gasket materials. Approval of the joint detail DRAWINGS shall not relieve CONTRACTOR of any responsibilities to meet all of the requirements of these SPECIFICATIONS, or of the responsibility for correctness of CONTRACTOR's details.
- D. CONTRACTOR shall cooperate with ENGINEER in obtaining and providing samples of all specified materials.
- E. CONTRACTOR shall submit certified laboratory test certificates for all items required in this section.

1.5 Delivery, Storage, and Handling

- A. All pipe and fittings shall be delivered to the site and unloaded with handling that conforms to the manufacturer's instructions for reasonable care. Pipe shall not be rolled or dragged over gravel or rock during handling. The Contractor shall take necessary precautions to ensure the method used in lifting or placing the pipe does not induce undue stress fatigue in the pipe.
- B. Responsibility for Material:
 - 1. CONTRACTOR shall be responsible for all materials intended for the WORK that are delivered to the construction site and accepted by CONTRACTOR. Payment shall not be made for materials found to be defective or damaged in handling after delivery and acceptance. Defective or damaged materials shall be removed and replaced with acceptable materials at CONTRACTOR's expense.
 - 2. CONTRACTOR shall be responsible for the safe and proper storage and handling of Pipe materials.
 - a. Pipe and accessories furnished by CONTRACTOR shall be delivered to, unloaded, and distributed at the site by CONTRACTOR. Each pipe shall be unloaded adjacent to or near the intended laying location.
 - b. Pipe fittings, specials, valves, and appurtenances shall be unloaded and stored in a manner that precludes shock or damage. Such materials shall not be dropped.

PART 2 — PRODUCTS

2.1 Corrugated Polypropylene (PP) Pipe

2.1.1 General

- A. Twelve-inch (12") through Sixty-inch (60") pipe shall be ADS HP Storm Polypropylene Pipe or pre-approved equal. Pipe supplied shall be smooth interior and annular exterior corrugated

polypropylene (PP) pipe meeting the requirements of ASTM F2736, ASTM F2881 or AASHTO M330, Type S, for respective diameters. The pipe supplied shall be watertight as defined in the joint performance requirements of this specification.

- B. Virgin material for 12-inch through 60-inch pipe and fitting production shall be an impact modified copolymer meeting the material requirements of ASTM F2736, ASTM F2881 and AASHTO M330, for respective pipe diameters.

2.1.2 Joint Performance

- A. Watertight joints shall be bell-and-spigot meeting the watertight requirements of ASTM F2764 or ASTM F2881. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.

2.1.3 Fittings

- A. Fittings shall conform to ASTM F2764 or ASTM F2881, with the exception of meeting the watertight joint performance requirements of ASTM D3212. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477.
- B. Repair couplers may be utilized to connect field-cut pipe.

2.1.4 Installation

- A. Pipe installation shall be in accordance with Section 3 of this specification and the product manufacturer's published installation guides.

PART 3 — EXECUTION

3.1 Earthwork

- A. Excavation, trenching, and backfilling shall be as specified in 3.4.2-3.4.3 "Excavation and Fill."

3.2 Identification

- A. For all stormwater and subsurface drainage piping, install warning tape directly over pipe and at outside edges of underground structures.
- B. Detectable warning tape shall be installed over storm drainage piping and over edges of underground structures.

3.3 Piping Inspection

3.3.1 General

- A. Piping, fittings, and drainage structures shall be inspected prior to installation and any defective or damaged product shall be replaced.

3.3.2 Corrugated Polypropylene Pipe and Fittings

- B. Any pipe, fittings, or drainage structures with cuts, punctures, or other damage on the interior or exterior shall be rejected and replaced.
- C. Any pipe, fittings or drainage structures with damaged ends or joints, which would prevent proper sealing of the joints, shall be rejected and replaced.
- D. The pipe and pipe coatings shall be inspected by ENGINEER for damage or defects before being placed in the trench. Damaged or defective pipe shall not be installed.
- E. All pipes that do not meet the requirements of PART 2 of this section will be rejected and replaced at CONTRACTOR's expense.

3.4 Piping, Fitting, and Drainage Structure Installation

3.4.1 General

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm and drainage piping system. Location and arrangement of piping layout take design considerations into account. Install piping system as indicated herein and as directed by the product manufacturer, to extent practical. Where specific installation procedure is not indicated, follow product manufacturer's written instructions.

- B. All products shall be inspected for defects and cracks before being lowered into the trench, piece by piece. Any defective, damaged or unsound pipe, fitting or drainage structure or any product that has had its grade disturbed after laying, shall be taken up and replaced. Open ends shall be protected with a pipe plug to prevent earth or other material from entering the pipe during construction. The interior of the pipe shall be free from dirt, excess water and other foreign materials as the pipe laying progresses and left clean at the completion of the installation.
- C. Install piping system beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions. Follow product manufacturer's instructions for the use of lubricants, cements, and other special installation requirements.
- D. Use Manholes or Catch Basins for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing utility is indicated.
- E. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

3.4.2 Trench Excavation

3.4.2.1 Excavation

- A. Within Easement, Cultivated, Landscaped, or Agricultural Area: All vegetation, such as brush, sod, heavy growth of grass or weeds, decayed vegetable matter, rubbish and other unsuitable material within the area of excavation and trench side storage shall be stripped and disposed of in accordance with the requirements of Section 31 11 00, Clearing and Grubbing.
- B. Within Unpaved Roadway Areas: CONTRACTOR shall strip the cover material from graveled roadways or other developed, but unpaved traffic surfaces to the full depth of the existing surfacing. The surfacing shall be stockpiled to the extent that it is acceptable and useable for restoration purposes.

- C. Within Paved Areas:
1. The removal of pavement, sidewalks, driveways, or curb and gutter shall be performed in a neat and skill manner. Concrete pavement, asphalt, sidewalks, driveways, or curb and gutter shall be cut with a power saw to a depth of two (2) inches prior to breaking. The concrete shall be cut vertically in straight lines and avoiding acute angles.
 2. Bituminous pavement, sidewalks, driveways, or curb and gutter shall be cut with a power saw, pavement breaker, or other approved method of scoring the mat prior to breaking or excavation. The bituminous mat shall be cut vertically, in straight lines and avoiding acute angles.
 3. Any overbreak, separation, or other damage to the existing bituminous or concrete outside the designated cut lines shall be replaced at CONTRACTOR's expense.
 4. Excavated paving materials shall be removed from the job site and shall not be used as fill or backfill.
- D. Excavate trenches to ensure that sides will be stable under all working conditions. Slope trench walls or provide supports in conformance with all local and national standards for safety. Open only as much trench as can be safely maintained by available equipment. Backfill all trenches as soon as practicable, but not later than the end of each working day.
- E. Where trench walls are stable or supported, provide a width sufficient, but no greater than necessary, to ensure working room to properly and safely place and compact haunching and other embedment materials. The space between the pipe and trench wall must be wider than the compaction equipment used in the pipe zone. Minimum width shall be not less than the greater of either the pipe outside diameter plus 16 in. or the pipe outside diameter times 1.25, plus 12 in. In addition to safety considerations, trench width in unsupported, unstable soils will depend on the size and stiffness of the pipe, stiffness of the embedment and in-situ soil, and depth of cover.
- F. When supports such as trench sheeting, trench jacks, trench shields or boxes are used, ensure that support of the pipe and its embedment is maintained throughout installation. Ensure that sheeting is sufficiently tight to prevent washing out of the

trench wall from behind the sheeting. Provide tight support of trench walls below viaducts, existing utilities, or other obstructions that restrict driving of sheeting.

3.4.2.2 Dewatering

- A. All pipe trenches and excavation for structures and appurtenances shall be kept free of water during pipe laying and other related work. The method of dewatering shall provide for a dry foundation at the final grades of excavation. Water shall be disposed of in a manner that does not inconvenience the public or result in a menace to public health. Pipe trenches shall contain enough backfill to prevent pipe flotation before dewatering is discontinued. Dewatering shall continue until such time as it is safe to allow the water to rise in the excavation.
- B. Do not lay or embed pipe fittings or drainage structures in standing or running water. At all times prevent runoff and surface water from entering the trench.
- C. When water is present in the work area, dewater to maintain stability of in-situ and imported materials. Maintain water level below pipe bedding and foundation to provide a stable trench bottom. Use, as appropriate, sump pumps, well points, deep wells, geofabrics, perforated underdrains, or stone blankets of sufficient thickness to remove and control water in the trench. When excavating while depressing ground water, ensure the ground water is below the bottom of cut at all times to prevent washout from behind sheeting or sloughing of exposed trench walls. Maintain control of water in the trench before, during, and after pipe system installation and until embedment is installed and sufficient backfill has been placed to prevent flotation of the pipe, fitting, or drainage structures. To preclude loss of soil support, employ dewatering methods that minimize removal of fines and the creation of voids in in-situ materials.

3.4.2.3 Removal of Rock

- A. Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between exposed rock and the pipe of at least 12 inches (0.3m). Where Bell-and-Spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight

portion of the pipe. Rock excavation shall be as specified and defined under section 02300 Earthwork.

3.4.2.4 Removal of Unstable Material

- A. Where wet or otherwise unstable soil incapable of properly supporting the pipe system, as determined by the Engineer, is encountered in the bottom of a trench, such material shall be removed to at least 24 inches below bottom of pipe and replaced to the proper grade with select granular material, compacted as directed by the engineer. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Owner.

3.4.3 Installation

- A. General: Precautions shall be taken to prevent foreign material from entering the pipe before or while it is being placed in the line. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe. The open ends of pipe shall be closed with a plug, or with other devices approved by ENGINEER, at times when pipe laying is not in progress.
- B. Pipe:
 - 1. Storm drain pipe shall be installed in accordance with the manufacturer's recommendations for installing the type of pipe used, and what is shown on the DRAWINGS or unless allowed and approved by ENGINEER or city inspector.
 - 2. Pipe lines shall be laid to the grades and alignment shown on the DRAWINGS or staked by ENGINEER. Variation from the prescribed grade and alignment shall not be allowed unless approved by ENGINEER.
- C. Pipe Fittings:
 - 1. Pipe fittings shall be laid so as to form a close concentric joint with the adjoining pipe to avoid sudden offsets of the flow line. Pipe sections shall be joined together in accordance with the manufacturer's recommendations.
 - 2. Pipe fittings and appurtenances shall be carefully lowered into the trench with suitable tools or equipment to

prevent damage to the pipe and linings; pipe and accessory materials shall not be dropped or dumped into the trench.

- D. Gaskets: No gaskets that show signs of deterioration, such as surface cracking or checking, shall be installed in a pipe joint. Gaskets that sustain damage during the installation process shall be removed and discarded.
- E. Obstructions not shown on the DRAWINGS may be encountered during the progress of the WORK. Should such an obstruction require an alteration to the pipe alignment or grade, ENGINEER will have authority to order a deviation from the DRAWINGS, or ENGINEER may arrange for the removal, relocation, or reconstruction of any structure, which obstructs the pipeline.
- F. Joints of precast concrete boxes and pipe shall be fully grouted both inside and outside the manhole using a non-shrink grout or as designated on the DRAWINGS. Brick, stone, or other masonry units may only be used to fill in the void between the pipe and structure wall if they are approved by the Engineer and fully grouted in place.

3.4.4 Bedding

- A. A stable and uniform bedding shall be provided for the pipe and any protruding features of its joint and/or fittings. The middle of the bedding, equal to one-third of the pipe outside diameter, shall be loosely placed while the remainder shall be compacted to a minimum of 95% of maximum density. Pipe bedding shall be a minimum of 4" – 6" in thickness. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.4.5 Placing Pipe

- A. Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Pipe shall not be laid in water, and the pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches shall be provided as directed by the engineer; see dewatering section.

3.4.6 Jointing

- A. Joints shall be constructed as described herein and in accordance with manufacturer's installation instructions.
- B. All Bell-and-Spigot pipe joints shall be thoroughly cleaned. Joint lubricant, supplied by the manufacturer, shall be liberally applied to entire interior of bell and gasket on spigot prior to assembly.

3.4.7 Backfilling

3.4.7.1 General

- A. Backfill placement and compaction shall be constructed in accordance with the specifications herein and the product manufacturer's published installation guides.

3.4.7.2 Backfilling Pipe in Trenches

- A. After the pipe and pipe system have been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layer depths to ensure minimum compaction density is obtained evenly throughout the backfill material. The backfill shall be brought up evenly on both sides of pipe and pipe system for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 6 inches above the top of the pipe when using light weight compaction equipment, or at least 12 inches above the top of the pipe when using medi. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Engineer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.4.7.3 Backfilling Pipe in Fill Sections

- A. Select bedding and backfill material may be required and shall be shown on the construction drawings.
- B. For pipe placed in fill sections, fill shall be constructed to at least 6 inches above the top of proposed pipe prior to trench excavation. Bedding shall be distributed in six-inch (6") maximum layers over the full width of the trench and simultaneously on both sides of the pipe. Special care shall be taken to ensure full compaction under the haunches and joints of the pipe. Fill shall be placed in 12-inch lifts and shall be compacted to achieve 90% of maximum density, or as shown on plans. Once fill is placed and compacted pipe trench shall be constructed in accordance with the Trench Excavation section of this specification.

3.4.7.4 Movement of Construction Machinery

- A. When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.4.7.5 Compaction

- A. Non-cohesive materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, non-cohesive soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.
- B. Minimum Density - Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which shall be 95% compaction for all soil types.

3.4.7.6 Determination of Density

- A. Testing shall be the responsibility of the Contractor and performed at no additional cost to the Owner. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval by the Engineer. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers shall be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D2922. When ASTM D2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in the Calibration paragraph of the referenced publications. ASTM D2922 results in a wet unit weight of soil and when using this method ASTM D3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D3017 or ASTM D2922. Test results shall be furnished to the Engineer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.5 Testing and Inspection

3.5.1 General

- A. Following the complete installation of all utilities (public and private), and prior to the placing of the final layer of pavement, all pipe shall be cleaned, and CCTV inspections shall be performed. Deflection and leakage tests for storm drain shall be required at the discretion of the Engineer when CCTV inspection indicates that there is a probability for leaks or when there are anomalies in the pipe that would indicate deflection.

3.5.2 CCTV Inspection

- A. A closed-circuit television (CCTV) inspection shall be conducted prior to storm drain utilities acceptance. Refer to this CCTV requirement in the Inspection Policy of the Guidebook of Standards and Practices for Development.

3.5.3 Tests for Deflection

- A. When inspection by CCTV indicates a potential for excessive deflection, the following test method shall be used.
- B. A deflection test shall be performed if the CCTV inspection indicates any anomalies in installation.
- C. The deflection testing shall be witnessed by the Inspector and shall be conducted by the Contractor at the Contractor's expense. Deflection shall be tested for excessive vertical deflection using a pre-sized, rigid mandrel or "Go-No-Go" device approved by the agency. The mandrel size shall be clearly labeled and shall be sized so as to provide a diameter of at least 95% of the allowable minimum inside diameter per ASTM D2881. Elbow and wye type fittings should not be mandreled.

3.5.4 Tests for Leakage

- A. When inspection by CCTV, or deflection testing indicates a potential for leakage at joints rated to be watertight, the following test method shall be used.

3.5.4.1 Corrugated Polypropylene (PP) Pipe Leakage Tests

- A. Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate.
- B. Low pressure air testing for plastic pipe shall conform to ASTM F1417. When leakage exceeds the maximum amount specified, satisfactory correction, as approved by the Engineer, shall be made and retesting accomplished.
- C. Infiltration and exfiltration testing shall conform to ASTM F2487. Prior to exfiltration tests, the pipe shall be completely backfilled. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Engineer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached equilibrium, not less than 4

hours and not greater than 72 hours. After equilibrium, the head shall be reestablished. The amount of water required to maintain this water level during a minimum of 15-minute, maximum 24-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 50 gallons per inch in diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction, as approved by the Engineer, shall be made and retesting accomplished.

- D. In lieu of low-pressure air testing and infiltration/exfiltration testing in Sections B and C above, joint isolation testing of each joint may be performed in accordance with ASTM C1103. Air or water may be used to pressurize the void space being tested.