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This is a supplement to the *Standard Specification for Municipal Services* specific to the requirements of Halifax Water.

PART 1 - GENERAL

1.1 Work Included

- .1 This section specifies requirements for constructing force mains. Work includes supply and installation of pipe and fittings.

1.2 Related Sections

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|----|---------------------------------------|---------------------|
| .1 | Concrete | SECTION 03 30 00 |
| .2 | Metal Fabrications | SECTION 05 50 00 |
| .3 | Earthwork | SECTION 31 20 00 |
| .4 | Reinstatement | SECTION 32 98 00 |
| .5 | Manholes, Catch Basins and Structures | SECTION 33 39 00 |
| .6 | Standard Details | HW STANDARD DETAILS |

1.3 Reference Standards

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|----|---------------------|--|
| .1 | ASME B16.1-15 | Gray Iron Flanges and Standards Flanged Fittings, Class 25, 125 and 250. |
| .2 | AWWA C104/A21.4-16 | Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water. |
| .3 | AWWA C110/A21.10-12 | Ductile-Iron and Gray-Iron Fittings. |
| .4 | AWWA C111/A21.11-17 | Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings. |
| .5 | AWWA C151/A21.51-17 | Ductile-Iron Pipe, Centrifugally Cast, |

		for Water.
.6	AWWA C153/A21.53-11	Ductile Iron Compact Fittings.
.7	AWWA C301-14	Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
.8	AWWA C303-17	Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
.9	AWWA C509-15	Resilient-Seated Gate Valves for Water-Supply Service.
.10	AWWA C515-15	Reduced-Wall, Resilient Seated Gate Valves, for Water and Sewerage Systems.
.11	AWWA C900-16	Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 60 in. (100 mm Through 1500 mm).
.12	AWWA C901-08	Polyethylene (PE) Pressure Pipe and Tubing, ½ in. (13mm) Through 3 in. (76mm), for Water Service.
.13	AWWA C906-15	Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100mm) Through 65 in. (1,650mm), for Waterworks.
.14	AWWA C909-16	Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe 4” and Larger.
.15	CSA B137 Series-17	Thermoplastic Pressure Piping Compendium.
.16	ULC 701-11	Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with SECTION 01 10 00 for all pipe, fittings, valves and all other items necessary for a complete force main Wastewater System installation.

1.5 Certificates

- .1 Submit manufacturer's test data and certification that products and materials meet requirements of this SECTION in accordance with SECTION 01 10 00.
- .2 For fusion jointing of pipe, provide certification that personnel are trained by manufacturer in current methods and use of equipment.

1.6 Handling and Storage

- .1 Handle and store pipe, valves and fittings, in such manner as to avoid shock and damage. Do not use chains or cables passing through pipe bore. Do not damage coatings or linings.
- .2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

PART 2 - PRODUCTS

2.1 General

- .1 Diameter, material and strength class of pipe and fittings: as indicated.

2.2 Polyvinyl Chloride Pipe and Fittings

- .1 Pipe and joints:
 - .1 Polyvinyl chloride DR18: to CSA B137.3 or B137.3.1, AWWA C900, AWWA C905, or AWWA 909.
- .2 Fittings:
 - .1 PVC: to CAN/CSA B137.
- .3 Fusible PVC pipe and joints:
 - .1 100mm diameter and larger: to CSA B137.3, AWWA C900 or AWWA C905.
 - .2 Joints: thermal butt fusion.

2.3 Polyethylene Pipe and Fittings

- .1 Pipe:
 - .1 13 to 76mm diameter: to AWWA C901.
 - .2 100mm diameter and larger: to AWWA C906.
- .2 Joints:
 - .1 Thermal Butt Fusion.
 - .2 Mechanical Connections: polyethylene flange end with metal back-up ring. All metallic hardware for connections to be 316L stainless steel.
 - .3 Electrofusion.
- .3 Fittings:
 - .1 Polyethylene: to AWWA C901 and AWWA C906.

2.4 Plug Valves

- .1 Service: Wastewater, pump, and other equipment isolation.
- .2 Rugged, eccentric type plug valves suitable for raw sewage service and minimum of 90% full port area.
- .3 Rating: 1050 kPa at 37°C.
- .4 Body: ASTM A126 Class B cast iron with nickel-welded raised seats, to AWWA C517, complete with ASME B16.1 Class 125 flanged end connection.
- .5 Plug: Buna N or Neoprene coated for resilient plug face and bubble tight shut off.
- .6 Bearings: stainless steel and Teflon permanently lubricated.
- .7 Packing: Buna N or Teflon combination.
- .8 Bolted bonnet design repackable without removing bonnet.
- .9 Actuator (chamber installed valves): lever actuator for 150 mm and smaller valves; geared actuator with handwheel for valves greater than 150 mm; actuator to be supplied by valve manufacturer. Geared actuators to indicate valve position and have permanently lubricated bearings, cast or ductile iron housing and seals against dirt and water.
- .10 Actuator (direct bury valves): valve box with stem extension and ground level position indicator. Geared actuator, as supplied by valve manufacturer, for valves greater than 150 mm.

2.5 Air Release, Air/Vacuum & Combination Air Valves

- .1 Service: sanitary sewage:
 - .1 Air-Vacuum valve for relief of vacuum and release of air.
 - .2 Air-release valve for release of air only.
- .2 Valve sizes 75 mm and smaller to have full size NPT inlets and outlets equal to the nominal valve size to AWWA C512. Body inlet connection to be hexagonal for wrench connection. Valve sizes 100 mm and larger to have bolted flange inlets

with threaded or plain outlets and protective hoods to prevent debris from entering the valve. Flanges to be in accordance with ASME B16.1 for Class 125.

- .3 Valve to have two (2) additional NPT connections for gauges, testing, and draining.
- .4 Valve body to provide a through flow area equal to the nominal valve size. Provide a bolted cover with alloy screws and flat gasket to allow for maintenance and repair.
- .5 Provide a guarantee for floats against failure including pressure surges. Float to have a hexagonal guide shaft supported in the body by circular bushings to prevent binding from debris. Protect float against direct water impact by an internal baffle.
- .6 Resilient seat to provide drop tight shut off to the full valve pressure rating. Seat to be a minimum of 12 mm.
- .7 On valve sizes 100 mm and larger, fit the cover to the valve body by means of a machined register to maintain concentricity between the top and bottom guide bushings at all times.
- .8 Valve body, cover, and baffle to be constructed of ASTM A126 Class B cast iron or ductile iron. Float, guide shafts, and bushings to be constructed of Type 316 stainless steel. Non-metallic guides and bushings are not acceptable. Resilient seats to be Buna-N.
- .9 Valves to be installed in concrete chambers. Refer to HW STANDARD DETAILS.

2.6 Valve Boxes

- .1 Valve boxes for new installations or replacements as follows:
 - .1 Cast iron, slide type, adjustable for depth of pipe below finished grade or; composite valve box with one piece ABS lower and ductile iron upper (minimum length 686 mm). Maintain minimum of 125 mm between the top of the lower and flange of the upper. Lower valve box section minimum length 1.5 metres, refer to Halifax Water STANDARD DETAILS.
 - .2 For use on Type 2, Type 3 and Type 4 adjustments.
 - .3 Intermediate adjustments are not permitted.

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- .4 Mark covers *Sewer*, as applicable.
 - .5 Lugged to prevent turning and rolling of cover, and cover notched to suit.
 - .6 Bonnet on the bottom section which is capable of enclosing the packing gland section of the gate valve.
 - .7 Acceptable products:
 - .1 IMP model V.1.
 - .2 Mueller MVB 070C-27 composite valve box.
 - .3 Sigma valve box.
 - .4 Bibby Ste Croix CVB
 - .5 Other manufacturers, as required by the valve manufacturer to ensure proper functionality of the valve.
 - .2 Valve boxes: (For Type 2, Type 3 & Type 4 adjustments) as follows:
 - .1 Type 2 valve adjustments is as follows: The excavation and adjustment of upper valve box extension sleeve, setting top to finished grade and reinstatement to match existing grade.
 - .2 Type 3 valve adjustments is as follows: The supply and installation of upper valve box and cap (and intermediate section if required), excavation and adjustment of upper valve box extension sleeve; centering over the valve operating stem, setting top to finished grade and reinstatement to match existing grade.
 - .3 Type 4 valve adjustments is as follows: The supply and installation of both the upper, intermediate and lower valve box sections and cap, excavation, adjustment and replacement of upper valve box extension sleeve. Item also includes the centering of the new valve box sections over the valve operating nut, the setting of the top to finished grade and reinstatement to match existing grade.

2.7 Thrust Restraint

- .1 Thrust blocks and anchors: Use 25 MPa concrete and 15M, grade 400 reinforcing steel where indicated. Refer to Halifax Water STANDARD DETAILS.
- .2 Joint restraint device: 100 mm to 600 mm joint restraint device to AWWA C111/A21.10 and C153/A21.53 for mechanical or push-on joints with multiple wedge or gripper ring restraining mechanism, minimum working pressure rating 2410 kPa and minimum safety factor of 2:1. Installation is not to require special tools.
- .3 Mechanical joint restraint devices are generally to be used in combination with concrete thrust blocks. Mechanical joint restraint devices alone are permitted on 11.25°, 22.5° and 45° horizontal bends for sizes up to 300 mm diameter. No pipe joints are permitted within the “minimum pipe length”, refer to Halifax Water STANDARD DETAILS.

2.8 Insulation

- .1 Insulation to ULC 701, type 4, for extruded polystyrene. Minimum 40 psi compressive strength and 50 mm thick.

2.9 Trace Wire

- .1 RWU90, number 10 gauge (AWG), single stranded, insulated copper wire with 60mil of black cross-linked polyethylene (XCPE) insulation specifically manufactured for direct burial application or approved equivalent.
- .2 Make all spliced or repaired wire connections in the trace wire system using a Wing-Nut Wire Connector, model 454 (for two or four number ten wires), or approved equivalent, and made waterproof using an approved buried service wire closure.
 - .1 Buried service wire closure products:
 - .1 Klick–It II model C8816.
 - .2 Raychem GHFC-2-90.
 - .3 DryConn Direct Bury Lug Aqua.

- .4 Tracer-Lock Connector
- .3 Trace wire test stations are to be installed at 300 metre intervals.
 - .1 Acceptable products are as follows:
 - .1 Handley Industries T452.
 - .2 Snakepit Model #22408.

2.10 Anode Packs

- .1 Zinc anodes (ZN24-48) to ASTM B418, complete with clamps, as directed.
- .2 Magnesium alloy anodes to ASTM B843-13.

2.11 Marker Tape

- .1 Detectable metallic tape, 50mm wide, placed in trench upon bedding surround of pipe.

PART 3 - EXECUTION

3.1 Preparation

- .1 Inspect products for defects and remove defective products from site.
- .2 Clean all pipe, fittings, valves and appurtenances of debris and water before installation.

3.2 Excavation, Bedding and Backfilling

- .1 Perform excavation, bedding and backfilling to SECTION 31 20 00 with the following exceptions:
 - .1 Common selected backfill is defined in SECTION 31 20 00 as follows:
 - .1 Common: excavated soil which is not rock, unsuitable, or topsoil.
 - .2 Selected Backfill: common which is free from stumps, trees, roots, sods, organics, rocks, boulders, and masonry larger than 200 mm in any dimension; and other deleterious materials.
 - .2 Use Type 1 gravel for pipe bedding and protection unless otherwise specified.
 - .3 Place pipe bedding by hand and compacted in 150 mm thick layers.
 - .4 Use clear stone in wet or freezing conditions where specified or in consultation with Halifax Water prior to the installation.
 - .5 Blasting is not permitted within 10 metres of a force main.

3.3 Pipe Installation

- .1 Provide 24 hours' notice to Halifax Water prior to commencement of pipe installation.
- .2 Lay and join pipe, fittings, and valves, as specified herein and according to manufacturer's published instructions.

- .3 Do not lay pipe and fittings when the trench bottom is frozen, underwater or the trench or weather conditions are unsuitable.
- .4 Lay pipe and fittings on prepared bed, true to line and grade indicated, within the following tolerances:
 - .1 Horizontal Alignment: 150 mm.
 - .2 Vertical Alignment: 75 mm.
- .5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.
- .6 Face the bell ends in the direction of installation. On grades of 2% or greater, lay pipe up grade. For grades exceeding 16%, install an appropriately designed gradient thrust restraint.
- .7 Align pipes before joining.
- .8 Install gaskets as recommended by the manufacturers. Use only lubricant supplied by manufacturer. During cold weather store gaskets in heated area to promote flexibility.
- .9 Support pipes as required to assure concentricity until joint is completed.
- .10 Keep pipe joints free from mud, silt, gravel or other foreign materials.
- .11 Avoid displacing the gasket or contaminating them with dirt, or other foreign materials. When a gasket is contaminated, remove, clean, re-install and lubricate the gasket. Do not reuse a gasket that has been contaminated with petroleum products.
- .12 Where a deflection at a joint is permitted by the Engineer, deflect only after the spigot is fully inserted into the bell. Do not exceed maximum joint deflection recommended by the manufacturer.
- .13 Complete each joint before laying next length of pipe.
- .14 Provide a flexible joint, at structures, no more than 300 mm from outside face of structure. Support the pipe between the structure wall and the first joint with 20 MPa concrete.
- .15 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer. Do not damage pipe lining or coating and leave smooth beveled edge.

- .16 Provide concrete thrust blocks to undisturbed ground on all tees, bends, plugs and caps or as indicated on Project Documents. Construct as indicated and keep joints and couplings free of concrete.
- .17 Install mechanical joint restraint to AWWA C111/A21.10 and tighten lug nuts until all wedges are in firm contact with pipe surface. Continue to tighten alternating between bolts until lug nuts twist off.
- .18 Wrap all internally mechanical restrained bells with two bands of **RED** adhesive tape.
- .19 Install zinc anodes on all valves and appurtenances.
- .20 Install magnesium anodes to any connections to existing unwrapped ductile or cast iron pipe.
- .21 Install anti-corrosion petrolatum paste, tape and mastic to valve, bolts, valve bonnet nuts and bolts for corrosion protection.
- .22 Place marker tape upon bedding surround of pipe.

3.4 Undercrossing

- .1 Excavate working pit to dimensions as indicated.
- .2 Excavate working pit to not less than 0.6 metres below lowest invert of encasing pipe.
- .3 Dewater excavation.
- .4 Dewater area of under-crossing
- .5 Install heavy timber or steel frame backstop.
- .6 Place encasing pipe to exact line and grade as indicated. Encasing pipe to cross under obstruction at angle as indicated.
- .7 Install encasing pipe by jacking, boring or tunneling methods approved by Halifax Water.
- .8 Encasing pipe not to be in tension.
- .9 Joints for encasing pipe to be welded to AWWA C206.

- .10 Submit shop drawings showing proposed method of installation of carrier pipe.
- .11 For ductile iron carrier pipe only, install continuous zinc strip sacrificial anode electrically bonded to carrier pipe. Install sacrificial anodes for encasing pipe.
- .12 Insert carrier pipe into encasing pipe, in end with largest open area, after placing levelling pad.
- .13 Use fabricated high density polyethylene casing spacers to maintain carrier pipe in true alignment and uniform separation from encasing pipe.
- .14 Clearance between blocks or casing spacers and encasing pipe to be maximum 15 mm when carrier pipe is in position.
- .15 Join carrier pipe one length at a time outside encasing pipe. Push or pull carrier pipe into position.
- .16 Couplings of carrier pipe not to rest on levelling pad when carrier pipe is in position.
- .17 Place 20 MPa concrete cradle around carrier pipe after it is in position. Cradle to be minimum 225mm and maximum of 300 mm above levelling pad.
- .18 Seal annular space at each end of encasing pipe with manufactured end seal product or manufactured segmental sealing element. Metallic bolts and fasteners to be stainless steel 316L.

3.5 Valve Chambers

- .1 Construct valve chambers where indicated in accordance with applicable SECTIONS. Do not allow valve chamber to rest upon pipe.

3.6 Valves and Valve Boxes

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Install valve boxes on direct buried valves. Make valve box plumb and centered over operating nut, and true to line and grade.

- .3 Install zinc anodes on all valves as specified in Halifax Water STANDARD DETAILS.
- .4 Place select backfill material, maximum size 50 mm around valve box to subgrade.
- .5 Provide an asphalt apron around valve boxes outside of the paved street right-of-way. Refer to Halifax Water STANDARD DETAILS.
- .6 Install valves on PVC mains with a 450 mm x 450 mm pre-cast concrete block placed underneath for support. Refer to PVC handbook installation guide.

3.7 Pressure & Leakage Testing

- .1 Perform pressure and leakage testing of PVC piping to AWWA C605 and AWWA M23.
- .2 Perform pressure and leakage testing of PE piping to AWWA C906 and AWWA M55.
- .3 Provide, in writing to Halifax Water, the plan for pressure testing. The plan will indicate the areas to be tested and the sequence of testing.
- .4 All pressure testing to be witness by Halifax Water and the Applicant's Professional Engineer, or their representative. Provide Halifax Water 24 hours' notice to schedule the work.
- .5 Isolation of existing Halifax Water Wastewater System, where required, will be performed by Halifax Water Wastewater Operations. Do not operate any existing Halifax Water Wastewater System valves.
- .6 Test water is not to be supplied from a direct connection to the existing Halifax Water System.
- .7 Include all new pressurized Wastewater Service Connections, valves, force mains and other appurtenances in the pressure and leakage testing.
- .8 Place and compact base lift of gravels prior to pressure and leakage testing.
- .9 Provide labour, equipment and materials required to perform pressure and leakage testing. Provide a ¼ inch NPT connection at the appropriate location for the pressure gauge.

- .10 Open all new valves in test section.
- .11 Use potable water for all testing.
- .12 Expel air from the new force main and appurtenances by slowly filling with potable water. Install corporation stops at high points where no air vacuum release valves are installed. After testing, remove corporation stops and install plugs.
- .13 Conduct test at a minimum pressure of 1035 kPa or 1.5 times the operating pressure at the lowest point of elevation of the new force main being tested. Test pressure not to exceed 1205 kPa.
- .14 Conduct test over a full two (2) hour period, maintaining a constant test pressure. No leakage is permitted during the test period.
- .15 If any test fails, repair or replace defect and retest section until specified testing requirement is achieved.
- .16 Repair visible leaks regardless of test results.

3.8 Trace Wire

- .1 Install trace wire on all force mains and pressurized Wastewater Service Connections. Install trace wire in such a manner as to be able to properly trace all force mains and pressurized Wastewater Service Connections without loss or deterioration of signal or without the transmitted signal migrating off the trace wire.
- .2 Install trace wire test stations at 300 metre intervals along force main.
- .3 At the point of connection between the ductile iron force main, with any non-ductile iron force main or pressurized wastewater service connection, connect the trace wire to the first valve box, or as directed by Halifax Water.
- .4 Lay trace wire flat and securely affix to the pipe at three metre intervals. Protect the trace wire from damage during the excavation of the works. At pressurized wastewater service saddles, the trace wire is not permitted to be placed between the saddle and the force main.
- .5 Except for approved spliced in connections, trace wire is to be one continuous piece without breaks or cuts from valve box to valve box.

- .6 Test the trace wire system for functionality by Halifax Water only after the contractor has confirmed and demonstrated that the entire trace wire system is installed and is functioning properly.
- .7 If deficiencies are found in the trace wire system by Halifax Water, the Contractor will be invoiced for the cost of additional site visits incurred by Halifax Water to retest the trace wire system.

3.9 Valve Chambers / Drain Chambers

- .1 Install/Construct valve chambers and drain chambers where indicated in accordance with applicable SECTIONS. Valve chamber is not to rest upon pipe.

3.10 Thrust Blocks

- .1 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers and fittings and undisturbed ground as indicated or directed by Halifax Water.
- .2 Place 6 mil polyethylene between interface of concrete and fitting.
- .3 Provide mechanical joint restraint devices where specified.
- .4 Keep joints and couplings free of concrete.
- .5 Do concrete in accordance with SECTION 03 30 00 as indicated.
- .6 Thrust block installation to avoid manholes in common trenches.
- .7 Use timber blocking (hardwood sized to withstand thrust restraint against undisturbed earth or against a concrete thrust block) as reaction backing for plugs and caps. Timber blocking to allow future removal without disturbing pipe, cap or bedding.
- .8 Do not backfill over concrete within 24 hours after placing.