

1. GENERAL

1.1 RELATED WORK

- .1 Trenching, Backfilling and Compaction Section 02221.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings according to Section 01300. Provide shop drawings for pipe, insulation, coating, portable foam pads, heat trace, etc.

1.3 INSPECTION AND HANDLING

- .1 All material is subject to inspection and test for soundness and suitability at the discretion of the Engineer.
- .2 All pipe shall be jointed in strict adherence to the manufacturer's instructions, which are considered as part of these Specifications. As each section of the system is completed, it shall be tested in the manner specified, and in the presence of, and as approved by, the Engineer.
- .3 All material found, during the progress of the work, to have cracks, flaws, or other defects, or to be doubtful quality will be rejected by the Engineer. All rejected materials shall be promptly removed from the site of the work by the Contractor.
- .4 All material shall be removed from the barge and distributed at the site by the Contractor. All pipe, fittings, and valves shall be loaded and unloaded to avoid damage. Under no circumstances shall such materials be dropped. Insulated pipe shall not be skidded on the ground or against pipe already on the ground.
- .5 Pipe shall be handled so that exterior and interior surfaces, prefabricated joints, insulation, etc. will not be damaged. If, however, any part of any surface is damaged, the repair shall be made by the Contractor at his own expense.

2. PRODUCTS

2.1 HIGH DENSITY POLYETHELENE PIPING (SUPPLIED BY GN)

- .1 The high-density polyethylene pipes; manufactured from Type 3, Class C, Category 5, Grade P34 resin according to ASTM D1248. The polyethylene pipe must meet the toxicity requirements of CSA B137.0. The pipe shall be designated P.E. 3408 (800 HDS) and meet the requirements of ASTM F714.
 - .1 Pipe sizing is nominal iron pipe sizes (IPS) except 25 mm diameter pipes that are designated CTS.
 - .2 All polyethylene pipe, fittings, stub ends, conduits, etc. shall be KWH Sclairpipe.

- .3 No joints will be allowed in piping covered with shop applied insulation.
- .2 Insulation and External Polyethylene Coatings:
 - .1 Insulation will be factory applied Urecon UIP System rigid polyurethane foam insulation of 50 mm minimum thickness to ASTM D1622 not less than 0.035 gm/cm³ density.
 - .2 Closed cell content (ASTM D2856) not less than 90%.
 - .3 Water absorption not greater than 4.0% by volume (ASTM D2842-69).
 - .4 Thermal conductivity (ASTM C-158), not greater than 0.174 kcal/cm/hr/m5⁰C.
 - .5 Dimensional stability (ASTM D2126) 3%.
 - .6 Compressive strength (ASTM D1621) not less than 206 kPa.
 - .7 External polyethylene coating (jacket) will be double tape wrap Urecon UIP System. High density polyethylene jacket shall be minimum 1.27 mm thickness, minimum 25 kg/cm width tensile strength, black colour, factory bonded to surface of foam insulation and shall be factory-applied, hot in two counter-wound and overlapping layers so no seams align. Jacket shall be applied over mirror-smooth urethane insulation surface with integral polymeric skin.
 - .8 Pipe Insulation over the heat tracers described in Section 16867 installed at the hydrant vaults will be 1 inch Fibreglass Insulation installed as per manufacturer's specifications for heat tracer on pipe application.
- .3 Piping Types:
 - .1 The pipe for the water mains; will be 200 mm diameter DR 9 High Density Polyethylene pipe cast in polyurethane insulation having a minimum thickness of 50 mm.
 - .2 The pipe for sewer mains will be 150mm DR 13.5 High Density Polyethylene pipe cast in polyurethane insulation having a minimum thickness of 50 mm.
 - .3 The sanitary services lines and water service protective carrier; 100 mm diameter DR 13.5 High Density Polyethylene with 50 mm polyurethane insulation.

- .4 The water service supply and return lines will be 25 mm diameter CTS (Copper Tube Size) DR 9 High Density Polyethylene pipe.

2.2 INSULATION AND EXTERNAL POLYETHELENE COATINGS

- .1 All cutbacks of insulation shall be repaired with field applied polyurethane, and covered with mastic coat. Exposed pipe ends in cut back areas shall be externally protected with 0.8 mm coat of AFlintkote - Superior® asphaltic mastic No. 110-14.
- .2 A second coat of asphaltic mastic shall be field applied over shop-applied mastic.

2.3 PORTABLE INSULATION FOAM PACK

- .1 Field applied insulation shall be polyurethane foam insulation from factory pressurized portable kits.
- .2 The foam insulation shall conform to the following specifications:
 - .1 Density 36 kg/m³ ;
 - .2 Compressive Strength 0.02 kg/m²
 - .3 K factor aged 1.98 k cal/cm h²/EC
- .3 The portable insulation foam packs shall be Portafoam 160 or Portafoam 600.

2.4 HEAT SHRINK TAPE

- .1 Heat shrink tape; made of cross linked polyolefin backing with a hot melt adhesive coating.
- .2 Physical Properties:
 - .1 Backing Thickness 0.43 mm (17 mil)
 - .2 Adhesive Thickness 0.76 mm (30 mil)
 - .3 Service Temperature -40EC to 60EC
 - .4 Tensile Strength 2.32 kg/m² at 23EC
- .3 The heat shrink tape shall be manufactured by Talon Ltd.

2.5 HEAT SHRINK SLEEVES

- .1 Heat shrink sleeves shall be used to provide continuous jacketing in areas where jointing of the piping and fittings are required. The shrink sleeve may be either a continuous sleeve or a wrap around shrink sleeve, consisting of a radiation cross linked polyolefin backing precoated with a high strength adhesive. The sleeves are to be black in colour and suitable for use in both above ground and buried applications.
- .2 Physical Properties:
 - .1 Recovered Thickness 1.5 mm
 - .2 Tensile Strength 212 kg/cm⁵
 - .3 Elongation 550%
 - .4 Water Absorption 0.07%
- .3 The heat shrink sleeves shall be manufactured by CANUSA Ltd. or Raychem Ltd.

2.6 INSULATION KITS

- .1 Insulation kits; used to cover flange fittings, but fused joints and all other components where the shop applied polyurethane insulation and jacket cannot be installed prior to construction.
- .2 The insulation kits shall consist of two half shells of polyurethane rigid insulation equivalent to the material specified for the pipe coatings, providing a minimum of 50 mm clear cover of insulation over flanges, fittings, etc. The half shells are to be shop coated with Fibreglass Reinforced Plastic (FRP) or Urecon BL-75-20 EP protective coating. In addition to the coated half shells the kits will include silicone caulking, stainless steel strapping and heat shrink sleeves to provide a seal between the kits and pipe insulation.
- .3 The Urecon Part Number for the flange kits are as follows:

Pipe Diameter	Kit Part No.
100 mm	F253
150 mm	F254
200 mm	F255
250 mm	F256

- .4 Insulation kits for the butt fused pipe joints; Urecon Insulation Ltd. with BL-75-20-EP protective coating supplied by the Owner. The Urecon Kit Part Number of the butt fused pipe joints insulation kits are as follows:

Pipe Diameter	Kit Part No.
100 mm	J105
150 mm	J106
200 mm	J107
250 mm	J108

2.7 BACKING RINGS

- .1 The Backing Rings (Slip-On Metal Flanges); supplied with the HDPE fittings they are to be used with. The backing rings shall be hot dipped galvanized ductile iron. The bolt hole circle, diameter and spacing shall match ASA 125# flanges.

2.8 BUTT FUSION STUB ENDS

- .1 Butt fusion stub ends; provided by KWH Sclairpipe DR 13.5 series rating HDPE stub ends.

2.9 GASKETS

- .1 Gaskets for use at stub ends and other similar locations shall; reinforced, heavy cloth insert black rubber compound suitable for high pressure applications. The gaskets shall be 3 mm thick and be manufactured to suit the appropriate bolt circles for various pipe sizes. Under no circumstances are field fabricated gaskets to be used.

2.10 BOLTS AND NUTS

- .1 Bolts and nuts; steel with the bolt heads being a regular heavy hex and the nuts a heavy semi-finish hex. The nuts and bolts are to be hot dip galvanized or Stainless Steel ASTM-F593/ F594 Group 1. The length and size of bolts supplied shall be suitable to meet the pipe manufacturers= recommendations for flanged connections.

2.11 WARNING TAPE

- .1 Brady Identoline Tape (W.H. Brady Inc., Rexdale, Ontario) or Allen Markline (Allen Systems, Houston, Texas), polyethylene with a 4 mil minimum thickness.
- .2 Colour code:
- .1 Water: Safety precaution blue

- .2 Sewer: Safety precaution green
- .3 Imprint: black letters, one side only, repeated continuously:
 - .1 Water: A Caution Buried Water Line Below@
 - .2 Sewer: A Caution Buried Sewer Line Below@
- .4 Width: 150 mm.

2.12 VALVES

- .1 Main stops, 25 mm diameter. Fort F1100 or 50 mm diameter. Fort B1101-7 with pack joint and seamless stainless steel insert stiffener for HDPE pipe.
- .2 Angle ball valves, 25 mm diameter. Ford BA444-444W with pack joint and seamless stainless steel insert stiffeners for HDPE pipe both ends.
- .3 Ball valves, 50 mm diameter. Ford B44-777 with pack joint and seamless stainless steel insert stiffener for HDPE pipe.

2.13 WATER AND SEWER SERVICE KITS

- .1 Typical water and sewer service kits are shown on the Drawings.
- .2 Sanitary sewer service saddles; Robar No. 2626 stainless steel with double stainless steel bolt closure at 90 degrees.
- .3 Water service tapping saddles; Robar No. 2706 Bronze saddle c/w IP Thread and BB wedges with double stainless steel straps.

2.14 PIPE FITTINGS

- .1 Steel fittings; constructed from Tube-Turn, standard wall welding fittings and 1030 kPa flanges. The fittings shall be hot dipped galvanized, inside and out after lubrication.
- .2 Flanged cast iron fittings; Grinnell 860 kPa, standard fittings, or approved equal, coated inside and out by hot dip galvanizing. Any asphaltic base paint is to be removed prior to galvanizing.
- .3 Screwed pipe and fittings; 1034 kPa standard screwed malleable iron, galvanized.
- .4 All bolts, nuts and washers shall be hot dipped galvanized.
- .5 Galvanizing shall conform to CSA G164, minimum 610 g/m².

2.15 POLYVINYL CHLORIDE (PVC) PIPE FITTINGS

- .1 Fittings for PVC piping shall be PVC socket fittings with Class (DR or Schedule) to match existing pipe which mates to fittings.
- .2 Fittings shall be solvent welded.

3. EXECUTION

3.1 PREPARATION

- .1 Clean pipes, fittings, and appurtenances of accumulated debris and water prior to installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 TRENCHING, BACKFILLING AND COMPACTION

- .1 Trenching, Backfilling and Compaction as per Section 02220.
- .2 Trench alignment and depth require Engineer=s approval prior to placing bedding material or pipe.

3.3 PIPE INSTALLATION

- .1 Lay pipe on prepared bed, true to line and grade.
- .2 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .3 Keep jointing materials and installed pipe free of dirt, water and other foreign materials. Whenever work is stopped, install a removable watertight bulbhead at open end of last pipe laid to prevent entry of foreign materials.
- .4 Insulation to cover all sections of water main. Unavoidable gaps are to be insulated with field applied urethane.
- .5 Do not lay pipe on frozen bedding.
- .6 Be careful not to damage insulation or protective jacket. Repair damaged insulation and protective jacket at no extra cost to the Owner. The damaged insulation shall be repaired with a Froth-Pak kit, trimmed and sealed with heat shrink. Heat shrink shall extend minimum 100 mm beyond damaged area.
- .7 Thermal butt-fusion of polyethylene pipe shall be carried out by a certified Fusion Technician following procedures specified by the pipe manufacturer. The technician shall have a minimum of two years experience and a copy of his resume shall be submitted to the Engineer for approval.

- .8 Flanged collars to be fused to polyethylene pipe shall be made from the same type and grade of polyethylene, from the same raw material supplier, as the pipe. Under no circumstances will socket fusion joints be permitted on polyethylene pipe.
- .9 Water mains and sewer mains shall be jointed by thermal butt-fusion.

3.4 ACCESS VAULTS INSTALLATION

- .1 Existing access vaults are to be reused.

3.5 SERVICE LINE INSTALLATION

- .1 The lot service lines for water and sewer shall be laid at a minimum 2% grade. The horizontal alignment of the services shall be as directed by the Engineer in the field.
- .2 The holes for the service line connections to the main will be cut with a hole saw and all coupons shall be supplied by the Engineer.
- .3 The sanitary sewer pipes and water service conduit of polyethylene pipe shall be jointed by thermal butt fusion. No joints shall be permitted in the 25 mm diameter HDPE water service pipes installed in the 100 mm diameter HDPE water service conduit. No splices will be allowed in heat trace cable.
- .4 The Contractor shall supply and install all materials according to the drawings for completely operational water and sewer services including heat trace, valves, piping, insulation, etc.

3.6 FIELD SPRAYING OF POLYURETHANE AND INSULATION FORMS

- .1 Field spraying of polyurethane is to be performed by experienced operators only.
- .2 Exposed polyurethane shall be coated with 0.8 mm coat of AFlintkote-Superior® asphalt mastic No. 110-14.
- .3 Steel insulation forms are to be of continuous welded construction, fabricated from 1.6 mm thick sheet steel, cleaned of all weld slag and other impurities then hot dipped galvanized. Damage to steel forms shall be repaired by Contractor using manufacturer's recommended procedures at no cost to the Owner.
- .4 Water service piping installed outside insulation forms shall be bundled and wrapped with heat transfer tape. Piping shall be wrapped with overlapping layers to prevent field sprayed urethane from contacting the piping.
- .5 The interior surfaces of the insulation forms and exterior surfaces of wrapped piping, piping and fittings shall be lightly coated with Esso Epic-102 grease to prevent bonding with the cast polyurethane.

- .6 Split insulation forms shall be secured with galvanized hexagonal screws or stainless steel gear clamps as indicated on the drawings.
- .7 Under this contract both the sewer and water service insulation form will be filled with field sprayed polyurethane insulation.

3.7 HEAT SHRINK SLEEVES / HEAT SHRINK TAPE

- .1 Heat shrink sleeves shall be used to provide a waterproof jacket where breaks in the factory applied outer shell have been caused by jointing of the piping, fittings or damage to the shell. Once all sleeves are installed, the piping shall have a continuous water proof jacketing.
- .2 Where limited physical working space or other restrictions prohibit the use of heat shrink sleeves, heat shrink tape may be used. The heat shrink tape shall be installed in two counter-wound layers so no seams align. The first layer shall be applied with a minimum 25% overlap and heat shrunk prior to the second counter-wound layer being applied. The second layer shall also have a minimum 25% overlap.
- .3 The Contractor shall allow the Engineer to inspect each heat shrink sleeve and heat shrink tape application prior to backfilling or permanently covering. All heat shrink applications rejected by the Engineer shall be redone by the Contractor at no cost to the Owner.

3.8 TESTING

- .1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described. Notify Engineer at least 48 hours in advance of all proposed tests. Perform tests in presence of Engineer.
- .2 Testing of Water and Sewer Services Lines:
 - .1 Once the sewer services lines and water carrier lines assembled and prior to the joints being insulated, water service lines being installed and the pipe bedding and backfill being placed, they shall be pressure tested. The ends of the sewer and water carrier lines to be tested shall be sealed off using blind flanges and gaskets. The lower ends of the lines shall receive the test pump discharge lines. The high ends of the lines shall receive a vent cock to discharge air from the line during the filling process. The sewer service lines and water carrier lines shall then be pressure tested following the testing procedure contained in item 3.8.2.3 of this section.

- .2 Once the water service lines are assembled, they shall be pressure tested. The ends of the water lines to be tested shall be sealed off with a curb stop at the mains and ball valves at the buildings. The lines shall be pressurized for the initial expansion phase following the testing procedure contained in item 3.7.2.2 of this section. The Test Procedure for DR9 HDPE pipe is 2.10 kPa. Once the initial expansion phase is complete, the piping shall be pressure tested for a period of three hours. At the end of the three-hour pressure test, all joints and connections in the service line shall be checked for signs of leakage, it shall be repaired by the Contractor and retested.
- .3 The cost for repairing the lines and retesting shall be borne by the Contractor. The Contractor shall observe the safety precautions and relax time requirements outlined herein.
- .3 Flush and clean out pipes after pressure tests.
- .4 Remove stops after satisfactory completion of test and seal holes with plugs, make repairs to insulation and external protective jacket as required.
- .5 Dispose of flushing water in a manner acceptable to the Engineer.

3.9 DISINFECTION OF WATER MAINS AND SERVICE LINES

- .1 Before being placed into service all new water mains, services, fittings, and valves shall be chlorinated throughout their entire lengths.
- .2 Provide residents with water during chlorination and testing. Provide all labour and materials necessary for chlorinating, flushing and starting up the new system; and 11 test kits necessary for testing the concentration of chlorine solution during chlorination of pipe.
- .3 Prior to starting the chlorination procedure, the Contractor shall provide a temporary water supply system to all buildings whose water supply is shutoff as a result of the chlorination. The temporary water system shall consist of an above ground water supply line hooked up to each building.
- .4 The method to be used to introduce the disinfectant into the line must be approved by the Engineer and the Department of Health. Chlorine must be added to attain a concentration of 50 parts per million throughout the system and this solution will then be retained for 24 hours, after which time the chlorine concentration must not have dropped below 10 ppm.
- .5 After chlorination is complete, the pipes shall be flushed throughout until the residual chlorine level in the replacement water is equal to the discharge. The Contractor shall then take samples of the discharge water and send them for bacteriological testing. The results of the testing shall be sent directly to the Engineer.

- .6 The samples shall be taken using sampling kits obtained from a laboratory capable of performing bacteriological tests. The Contractor shall be responsible for obtaining test kits, taking water samples to the laboratory within the laboratory=s specified time period. All chlorinating and testing shall be completed with an outdoor air temperature above 0EC.
- .7 If the bacteriological test results indicate the water is unsuitable for consumption, the Contractor shall re-chlorinate the lines and retest the water at his own expense.
- .8 Once the Engineer receives the results of the water tests indicating the water is acceptable for consumption the Contractor shall set the system in operation as directed by the Engineer.
- .9 The cost of temporary water services, disinfections and putting the pipes into service shall be included in the unit price for the supply and installation of piping.
- .10 The Contractor shall have a supervisor on site that is thoroughly familiar with chlorination procedures to do the work.

END OF SECTION 02510