

This specification outlines the requirements for the supply and installation of factory pre-insulated piping systems.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASME International

B16.1 Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASTM International

C272/C272M Standard Test Method for Water Absorption of Core materials for Sandwich Constructions

C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

D638 Standard Test Method for Tensile Properties of Plastics

D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))

D1000 Standard Test Methods for Pressure Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications

C1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique

D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics

D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics

D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120

D2657 Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

D2842 Standard Test Method for Water Absorption of Rigid Cellular Plastics

D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D3574	Standard Test Methods for Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams
D6226	Standard Test Method for Open Cell Content of Rigid Cellular Plastics
F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
<u>G14</u>	<u>Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)</u>
CSA Group	
B137	Thermoplastic Pressure Piping Compendium
C22.2 No. 130	Requirements for Electrical Resistance Trace Heating and Heating Device Sets

PART 2 GENERAL

2.1 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings: convene pre-installation meeting one (1) week prior to beginning work of this Section and on-site installation, with contractor's representative, Owner and Owner's Representative in accordance with Section 01300 - Construction Progress Schedule to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Scheduling:

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval by the Owner and adhere to interruption schedule as approved by the Owner.

.3 Notify the Owner minimum of 24 hours in advance of interruption in service.

2.2 SUBMITTALS

- .1 Submit in accordance with Section 01340 – Shop Drawings, Samples and Submissions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for factory pre-insulated piping systems for utility applications, insulation kits, heat tracing cables, controllers and appurtenances and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test reports: submit certified test reports for specified materials from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

2.1 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with the General Conditions, GC 41 – Shop Drawings.
- .5 Submit shop drawings for pre-insulated piping, insulation kits, heat tracing cables, controllers and appurtenances.

2.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01720 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for pre-insulated piping systems for incorporation into manual.
- .3 Record Drawings: submit data necessary to produce record drawings on project completion and following requirements:
 - .1 Give details of pipe material, location of fittings, maintenance and operating instructions.

2.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01600 – Material and Equipment and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

- .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect pre-insulated piping system materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 3 PRODUCTS

3.1 CARRIER CORE PIPE AND FITTINGS

- .1 Water mains and sanitary sewerage force mains:
 - .1 Polyethylene pressure pipes in accordance with ASTM F714:
 - .1 Type PE 3408.
 - .2 Dimension Ratio: as indicated in Contract Documents drawings.
 - .2.3 Pressure rating: as indicated in Contract Documents.
 - .2 Polyethylene to polyethylene joints: thermal butt fusion joined to ASTM D 2657 or flanged with ductile iron backing flanges.
 - .2.3 Class 125 Cast Iron Flanged Fittings in accordance with ASME B16.1.
 - .3.4 Plain End Polyethylene Fitting in accordance with CSA B137 for pipe sizes NPS 4 and under.
- .2 Sanitary sewer Mains:
 - .1 Polyvinyl chloride (PVC) Sewer Pipe and fittings in accordance with ASTM D3034, CSA B137.
 - .1 Standard Dimension Ratio: as indicated on contract drawings.
 - .2 PVC pressure pipe and fittings in accordance with CSA B137, ASTM D1785.
 - .1 Dimension Ratio: as indicated on contract drawings.
 - .1

3.2 FACTORY APPLIED INSULATION

- .1 Pipes to be cleaned of surface dust or dirt and treated if necessary to assure positive bond of foam to entire pipe surface.
- .2 Material: rigid polyurethane foam factory applied or factory applied rigid expanded polystyrene.

- .3 Insulation thickness: 50 mm minimum.
- .4 Density in accordance with ASTM D1622/D1622M, 0.032 to 0.048 gm/cm³.
- .5 Closed cell content in accordance with ASTM D6226, 90 % minimum.
- .6 Water absorption in accordance with ASTM D2842, 4.0 gm/1000 cm³, maximum 4.250 % by volume.
- .7 System compressive strength in accordance with ASTM D1621 with 50 mil jacket, 150 kPa minimum.
- .8 Thermal conductivity in accordance with ASTM C518, 0.0202 to 40.026 W/m·°C maximum.
- .9 Service temperature: minus 45 °C to plus 85 °C.
- .10 Centering of pipe within insulation: no more than plus or minus 6 mm off centre.
- .11 Protect insulation on both ends of pipe from moisture and sunlight by 3 mm thick continuous concentration of black asphalt mastic compound.
- .12 Insulation must completely fill space between pipe and conduit.

3.3 OUTER JACKET FOR BURIED APPLICATIONS

- .1 Material: factory applied polyethylene tape jacket with enhanced cold weather properties, black in colour (UV inhibited) or factory applied polyurethane/urethane jacket, black in colour.
- .2 Density of HDPE jacket: to ASTM D1505, 0.940 gm/cm³ minimum. PE tape.
- .3 Sealant: synthetic polymers or modified rubber mastic Butyl rubber & resin.
- .4 Jacket thickness: 1.27 mm minimum.
- .5 Elongation in accordance with ASTM D6381000, 300 % maximum 6 month test.
- .6 Service temperature: minus 45 °C to plus 85 °C maximum.
- .7 Water vapour transmission rate: 3 gm/m²/24 hr average.
- .8 Tensile strength: 6.8 kg/cm width minimum.
- .9 Impact strength: to ASTM G14, 7.79 N/m at minus 40 °C minimum.

3.4 OUTER JACKET FOR ABOVE GROUND APPLICATIONS

- .1 Material: factory applied galvanized lock seam, spiral steel outer jacket.

- .2 Spirally applied from continuous steel strip using lock seam.
- .4.3 ~~Jacket thickness: 18 to 22 mm gauge minimum, thickness spirally applied from continuous steel strip using lock seam, or;~~
- .4 ~~Factory applied polyethylene case, 0.38 mm thickness, black in colour.~~
- .2.5 Protective metal jacket for fittings: as indicated.

3.5 INSULATED PIPE JOINTS FOR BURIED APPLICATIONS

- .1 Material: rigid polyurethane half shells with heat shrink sleeves and mastic sealant to provide moisture proof seal or rigid expanded polystyrene half shells, with properties in accordance with subsection 3.2 of this Section.
- .2 ~~A moisture proof seal shall be provided with mastic sealants in accordance with subsection 3.9 of this Section and with heat shrink sleeves or spray on polyurethane/urethane coating.~~
- .3 Pre-formed rigid polyurethane halves, as indicated, with properties as described in this Section.
- .3.4 Heat shrink sleeves: adhesive coated cross linked polyethylene sleeve.
- .4.5 Sleeves: to cover entire exposed joint length plus overlap of 76 mm of pipe coating on either side.
- .5 ~~Spray on polyurethane/urethane coating, in accordance with subsection 3.3 of this Section, shall be applied by factory trained workers.~~
- .6 Waterproofing mastic sealant for coating exposed ends of insulation after field cutting or trimming has been carried out: as described in this Section.

3.6 INSULATED PIPE JOINTS FOR ABOVE GROUND APPLICATIONS

- .1 Material: rigid polyurethane half shells with heat shrink sleeves to provide strong, moisture proof seal as described in this Section or rigid expanded polystyrene half shells, with properties in accordance with subsection 3.2 of this Section.
- .2 A moisture proof seal shall be provided with silicone caulking circumferentially beaded around outer jacket of pipe 50 mm from pipe end as specified in accordance with subsection 3.9 of this Section and either:
- .1 ~~Adhesive coated cross linked polyethylene heat shrink sleeves to cover the entire exposed joint length plus overlap of 76 mm of pipe coating on either side and protected with rolled sheet steel 0.85 mm thick wrapped around and strapped into place to complete joint; or~~
- .1 ~~Spray on polyurethane/urethane coating to a minimum thickness of 3.25 mm with properties in accordance with subsection 3.3 of this Section.~~

- .3 Rolled steel sheet: 0.889 mm thick, wrapped around and strapped into place to complete joint.
- .4 Pre-formed rigid polyurethane halves: as indicated, with properties specified.
- .5 Heat shrink sleeves: adhesive coated cross linked polyethylene sleeve.
- .6 Sleeves: to cover entire exposed joint length plus overlap of about 76 mm of pipe coating on either side.
- .2.7 Waterproof mastic sealant for coating exposed ends of insulation after field cutting or trimming: as specified.

3.7 INSULATION KITS FOR FITTINGS

- .1 Material: rigid polyisocyanurate foam with polymer protective coating on all exterior surfaces including ends.
 - .1 ~~Supply Kk~~its to be supplied complete with silicone caulking for seams, stainless steel attachment straps and clips, and heat shrink sleeves to seal between pipe and insulation cover.
 - .2 Rigid polyisocyanurate foam insulation:
 - .1 Density in accordance with ASTM D1622/D1622M, 0.027 gm/cm³.
 - .2 Compressive strength in accordance with ASTM D1621, 131 kPa minimum.
 - .3 Closed cell content: 90 % minimum.
 - .4 ~~Water absorption in accordance with ASTM D2842C272/C272M, 0.02 g/m² less than 0.7 % by volume.~~
 - .5 K Factor in accordance with ASTM C518, 0.027 W/m·° C maximum.
 - .3 Polymer coating to ASTM D3574:
 - .1 Two component high density polyurethane coating, black in colour.
 - .2 Density: 1170 kg/m².
 - .3 Abrasion: durometer D scale: 60.
 - .4 Tensile strength: 11,000 kPa minimum.
 - .5 Tear strength: 26.5 N/mm minimum.
 - .6 Thickness: 1.9 mm outside surfaces, 0.51 mm inside surfaces.

3.8 INSULATION FOAMED IN PLACE

- .1 Material: two component polyurethane Class I4 foam, supplied in portable, disposable, pressurized container.
- .2 Density in accordance with ASTM 1622/D1622M, 0.035 to 0.039 gm/cm³.
- .3 Closed cell content in accordance with ASTM D6226, 90 % minimum.

- .4 Thermal conductivity in accordance with ASTM C518, 0.022 to 0.024 W/m·° C.
- .5 Compressive strength in accordance with ASTM D1621, 103 to 172 kPa at 10 % deflection, minimum.
- .6 Water absorption in accordance with ASTM D2842, 4.25 % maximum by volume.

3.9 INSULATION ACCESSORIES

- .1 Heat shrink tape for sealing insulation half shells against moisture adaptable to flexible installations:
 - .1 Crosslinked polyolefin backing with a hot melt adhesive coating.
 - .2 Backing thickness: 0.35 mm minimum.
 - .3 Adhesive thickness: 0.51 mm minimum.
 - .4 Service temperature: minus 40 to plus 60 °C maximum.
 - .5 Tensile strength: 20 MPa minimum.
- .2 HighLow density polyethylene tape for minor repair of the outer jacket or completion of straight insulation joints in field where irregular surfaces are not involved:
 - .1 Adhesive backed tape, heated to approximately 50 °C prior to installation and protected by easily removed release liner.
 - .2 Backing thickness: 0.178 mm average.
 - .3 Adhesive thickness: 0.711 mm.
 - .4 Service temperature: minus 34 to plus 85 °C.
 - .5 Tensile strength: 3.6 kg/cm width.
 - .6 Colour: black.
- .3 Asphalt mastic vapour barrier coating to waterproof exterior surfaces of half shells or sprayed in place foam:
 - .1 Colour: black
 - .2 Solids by volume: 62 %
 - .3 Coverage: 3 – 5 L/m²
 - .4 Drying time to touch: 4 hr maximum
 - .5 Drying time firm: 48 hr maximum
 - .6 Service temperature: minus 40 to plus 125 °C
 - .7 Application temperature: 4 °C minimum
 - .8 Moisture permeability: 3.2 mm wet film at 37.3 °C.
 - .9 90% relative humidity: to ASTM E 96, 02 perms.
 - .10 Shelf life: 12 months
 - .11 Water vapour permeability: 0.018 perms at 3 cm
- .4 Silicone caulking for joining faces of rigid urethane insulation:

- .1 Colour: black
- .2 Specific gravity: 1.02
- .3 Tensile strength: 25 MPa~~8 kg/cm²~~
- .4 Tear Strength: 25 MPa
- .4 Elongation: 400 %
- .5 Service temperature: 205 °C maximum

3.10 ELECTRIC HEAT TRACING

- .1 Heat tracing conduits:
 - .1 Consisting To consist of extruded plastic moulding and ~~to be~~ applied to pipe prior to application of insulation.
 - .2 To be Fastened securely ~~fastened~~ to pipe and sealed to prevent ingress of foam during insulation.
 - .3 Check Each conduit ~~to be checked~~ after insulating to ensure they ~~are it is~~ not plugged.
 - .4 Seals eEnds ~~to be sealed~~ prior to shipping to prevent foreign material from entering conduit while in transit or during installation.
- .2 Parallel circuit type electric tracing cable:
 - .1 Resistive parallel circuit type in accordance with CSA C22.2 No. 130, constant watt, power rating and voltage as indicated on contract drawings.
 - .2 Fluoropolymer inner and outer insulation jackets, and suitable for cutting to length in field.
 - .3 If pipe being traced is plastic, heat trace cable to have metallic grounding overbraid of sufficient conductivity to carry fault current and secondary Fluoropolymer extruded overjacket to CAN/CSA-C22.2 No. 130.
 - .3.4 Manufacturer to ensure that specified electric tracing cable and heat tracing conduit size are compatible, so that cable may be pulled in with relative ease.
 - .4.5 Standard of Acceptance: Urecon Thermocable, or approved equal.
- .3 Series type electric tracing cable:
 - .1 Resistive series circuit type in accordance with CSA approved, constant watt, power rating and voltage as indicated on contract drawings.
 - .2 Fluoropolymer inner and outer insulation jackets.
 - .3 Cable manufacturer to engineer cable for specific circuit length.
 - .4 Manufacturer to ensure that specified electric tracing cable and heat tracing conduit size are compatible, so that cable may be pulled in with relative ease.

- .5 Standard of acceptance: Urecon SC Heatrace Series Type Heating Cables for Long Line Electric Tracing, or approved equal.
- .4 Solid state controller:
 - .1 On-off control with 1 °C temperature differential for accurate control.
 - .2 Load switch:
 - .1 30A, 120/240V controllers - mechanical relay switch.
 - .2 15-60A, 575V controller – mechanical contactor.
 - .3 Low temperature sensor control to be factory preset at 3 °C for water or sewer, and 10 °C for fire protection water.
 - .4 High temperature sensor control to be attached to active zone of heat tracing cable and to serve as high temperature cut-out, factory preset at 65 °C.
 - .5 Rating: as indicated on contract drawings.
 - .6 Resistance temperature detectors (RTD): as indicated on contract drawings.
 - .7 Indicator lamps to be mounted on front of controller to indicate status of system.
 - .8 Alarms: controllers on main lines to be equipped with remote alarm contacts to activate an audible alarm and flashing red light for the following alarm conditions:
 - .1 Low temperature.
 - .2 High temperature.Alarm system to shut down once system conditions return to normal.
 - .9 Standard of Acceptance: Urecon Temperature Controllers or approved equal.
- .5 Terminal end seal kits to be certified for installation in damp conditions in accordance with CSA C22.2 No. 130 and to consist of:
 - .1 Constant watt:
 - .1 End connector.
 - .2 90 cm of polytetrafluoroethylene (PTFE) Teflon tape.
 - .3 Adhesive-lined heat shrink end cap.
 - .2 Self-regulating:
 - .3 Two heat-shrinkable tubes. Adhesive-lined heat shrink tubing.
- .6 Power connection kits to connect to pipe and in accordance with CSA C22.2 No. 130 as indicated.

- .1 Constant watt:
 - .1 Flexible conduit.
 - .2 ~~End caps~~~~Adhesive-lined heat shrink end cap.~~
 - .3 ~~12 AWG hook-up wire.~~
 - .4 ~~Splices~~
 - .3 ~~Adhesive-lined heat shrink sleeves~~~~tubing.~~
 - .4 ~~Power Splice.~~
- .2 Self-regulating
 - .1 Base.
 - .2 Top.
 - .3 Sealing gasket.
 - .4 Terminal block.
 - .5 Locknuts.

3.11 WARNING TAPE

- .1 Polyethylene tape: 150 mm wide by 0.15 mm thick as approved by the Owner.
- .2 Tape for water mains: blue in colour with factory applied markings at one metre intervals, i.e. "Caution Buried Water Line".
- .3 Tape for sanitary sewers: green in colour with factory applied markings at one metre intervals, i.e. "Caution Buried Sewer Line".

3.12 BURIED WARNING AND IDENTIFICATION TAPE

- .1 Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping.
- .2 Tape: detectable by electronic detection instrument.
- .3 Provide tape in rolls, 75 mm minimum width, colour coded for utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length.
- .4 Warning and identification: reading CAUTION BURIED PRE-INSULATED PIPING BELOW or similar wording.
- .5 Use permanent code and letter colouring unaffected by moisture and other substances contained in trench backfill material.

3.13 PIPE BEDDING AND SURROUND MATERIALS

- .1 In accordance with Section 02223 – Excavating, Trenching, and Backfilling.

3.14 ESCUTCHEON PLATES

- .1 Provide split hinge type metal plates for piping entering walls and floors in exposed spaces.
- .2 Provide polished stainless steel or as indicated plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

3.15 PIPE SLEEVES

- .1 Provide sleeves where piping passes entirely through walls and floors.
- .2 Ensure sleeves are of sufficient length to pass through entire thickness of walls and floors.
- .3 Provide 25 mm minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole.
- .4 Firmly pack space with mineral wool insulation.
- .5 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass or provide mechanically adjustable segmented elastomeric seal as indicated in the Contract Documents.
- .6 In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.
 - .1 For sleeves in masonry and concrete walls and floors provide hot-dip galvanized steel sleeves.
 - .2 Provide core drilling of masonry and concrete in lieu of sleeves when cavities in core-drilled hole are grouted smooth.
 - .3 In other than masonry and concrete walls and floors provide sleeves made from 0.5 mm thick galvanized steel sheet.

3.16 BACKFILL MATERIALS

- .5.1 In accordance with Section 02223 – Excavating, Trenching, and Backfilling.

PART 4 EXECUTION

4.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pre-insulated piping systems installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of the Owner.
- .2 Inform the Owner of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Owner.

4.14.2 UNLOADING AND HANDLING OF PRE-INSULATED PIPE

- .1 Unload from trucks or containers by hand or by lifting apparatus with fabric slings. Do not use cables or chains.
- .2 Once removed, store on smooth surface. Lay pipes flat. Where sleepers are desired use several lengths of wide planks to provide broad bearing surface.
- .3 Lift, do not drag, insulated pipes from storage area to job site.

4.24.3 REPAIRING DAMAGED PRE-INSULATED PIPE

- .1 Repair any damage to outer jacket by applying heat shrink sleeve to approval of ~~the Owner Company's Representative~~ or cover using heated HDPE UV resistant adhesive backed tape or cover with spray on polyurethane/urethane in accordance with Outer Jacket for Buried Applications or Outer Jacket for Above Ground Applications subsections ~~3.3 or 3.4~~ of this Section.

4.34.4 TRENCHING AND BACKFILLING

- .1 Do trenching and backfilling work in accordance with Section 02223 - Excavating, Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe as indicated.
- .3 Trench alignment and depth require Owner's approval prior to placing bedding material or pipe.

4.44.5 GRANULAR BEDDING AND SURROUND

- .1 Place bedding and surround material as indicated ~~in Contract Documents~~ and in accordance with Section 02223 - Excavating, Trenching and Backfilling.
- .2 Place bedding and surround material in unfrozen condition.
- .3 Place materials in uniform layers not exceeding 150 mm compacted thickness up to 300 mm above top of pipe.
 - .1 Compact each layer before placing succeeding layer.

- .4 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.
- .5 Shape transverse depressions in bedding as required to make joints.
- .6 Compact each layer full width of bed to at least 95 % maximum density to ASTM D698.
- .4.7 Fill authorized excavation or unauthorized over excavation below design elevation of bottom of specified bedding with approved granular material or rock underbedding as directed by the Owner.

4.6 CONCRETE BEDDING AND ENCASEMENT

- .1 Do concrete work in accordance with Section 03300 - Cast-in-Place Concrete. Place concrete to details indicated.
- .2 Position pipe on concrete blocks to facilitate placing of concrete.
 - .1 Anchor or weight pipe to prevent flotation when concrete is placed.
- .3 Do not backfill over concrete within 24 hours after placing concrete.

4.54.7 PIPE INSTALLATION

- .1 ~~Install pipe in accordance with Section 02713, Section 02702, Section 02704, or Section 02724. On dry ground, assemble shipping lengths of pipe into suitable installation lengths by heat butt-fusion.~~
- .2 Provide trained personnel and jointing machine approved by pipe manufacturer for butt-fusion jointing of polyethylene pipe.
 - .1 Obtain services of trained technician from pipe manufacturer to certify and train Contractor's personnel on jointing procedures and inspect jointing machine.
 - .2 Obtain letter from manufacturer certifying that Contractor's representatives who will perform jointing, are qualified and that jointing equipment has been inspected and is suitable for pipe supplied.
- .3 Follow manufacturer's instructions in butt-fusion of joints.
- .4 Join pipes at flanged ends in accordance with manufacturer's recommendations.
- .5 Recheck pipe joints assembled above ground after placing in trench to ensure no movement of joints has taken place.

4.6 INSULATION OF PIPE JOINTS

.1.6 Complete installation of rigid polyurethane, or rigid expanded polystyrene, halves on joints after laying pipe in trench and after successful pressure testing of pipe.

.1 Trim half shells to required length with handsaw to provide tight-fit in insulation gap between ends of factory insulation.

.2 No seam to exceed 3 mm in width at any joint.

.1 Match outer surface of shell with outer surface of insulation on pipe with tolerance of plus or minus 6 mm.

.2 Shave off any sharp edge with rasp or sharp knife.

.3 Hold half shells in place with masking tape while installing heat shrink sleeve.

.2.7 Install heat shrink sleeves using large broad flame propane torch to produce 600 mm flame.

.1 Peel back release liner 12 cm from end, centre sleeve over joint and press firmly down.

.1 Wrap sleeve around pipe, removing release liner as it is wrapped.

.2 If corner on underlap is not precut, then cutoff about 25 mm from each corner.

.2 Before completing overlap wrapping, warm underlap area approximately 12 cm until adhesive starts to appear at edge.

.2.1 Smooth out any wrinkles with gloved hand.

.3 Remove remaining release liner and complete wrapping.

.4 Remove release paper from closure seal, prewarm adhesive slightly, centre seal cover overlap and press down until well bonded.

.4.1 Heat closure seal, and press down with gloved hand to remove any bubbles and wrinkles.

.5 ~~Shrink sleeves around joint Ww~~ith torch; start at centre of sleeve, and shrink it all around joint.

.1 Keep torch moving using broad circumferential strokes to avoid burning.

.2 Continue shrinking sleeve toward one end until about 50 mm is left.

.3 Then aim torch inward towards centre and shrink edges.

.4 Repeat this operation on other end of sleeve.

- .5 Finish off by applying long horizontal strokes of torch all around sleeve.
- .6 Pay special attention to sleeve overlap area, ensuring no void remains along underlap edge.
 - .1 Use roller, or gloved hand to firmly and thoroughly press down along underlap edge.
 - .2 Start in centre and work outwards.
- .7 ~~Allow joint and sleeve to cool for at least 30 min before lowering pipe into trench. Joint and sleeve cool for at least 30 minutes before lowering pipe into trench.~~
- .8 Lay pipes on prepared bed, true to line and grade as indicated.
 - .1 No deviations without written approval of the Owner.
 - .2 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .3 Take out and replace defective pipe.
 - .4 Correct pipe which is not in true alignment or grade, or pipe which shows undue settlement after installation.
 - .5 Change method or equipment for setting alignment or grade if requested by the Owner.
- .9 Do not lay pipe on frozen bedding.
- .10 Do not let rocks or other foreign material, which might damage insulation jacket, fall on pipe.
- .11 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Install removable watertight bulkhead at open end of pipe to prevent entry of foreign materials.

4.74.8 INSULATION OF FITTINGS

- .1 Cut pipes as required to accommodate fittings and fitting insulation kits without damaging pipe insulation or its jacket.
 - .1 Leave smooth end at right angles to pipe axis.
- .2 Cracks larger than 6.4 mm to be filled with insulation foamed-in-place in following manner:
 - .1 Use strip of thin galvanized sheet metal wide enough to overlap both insulation kit and pipe by at least 8 cm and long enough to wrap around pipe leaving 2.5 cm opening on top.
 - .2 Hold metal in place with two tension metal or nylon straps, one at either end.
 - .3 Spray foam through opening on top into cavity.

- .4 Spray until cavity is almost half-filled on both sides of pipe. Foam will rise to complete filling.
- .5 Allow curing for 10 to 15 min.
- .6 Trim top and apply waterproofing sealant asphalt mastic, HDPE tape or heat shrink tape or sprayed on polyurethane/urethane to the appropriate thickness.

4.84.9 ELECTRIC TRACING

- .1 Install electric heat tracing, controllers, and appurtenances in accordance with manufacturer's recommendations.
- .2 At fittings and flanged joints seal heat trace channel with silicone caulking.
- .3 Cable conduit: in lengths as indicated.
 - .1 Splicing of heat-trace cable is not allowed unless approved by the Owner.
- .4 Install tracer cable conduit prior to installation of half shell joints, terminal seal kits, power connector kits, thermostatic controllers, in accordance with system supplier's instructions and as indicated.

4.10 THRUST BLOCKS

- .1 Do concrete work in accordance with Section 03300 - Cast-in-Place Concrete.
- .2 Place concrete thrust blocks between bends, tees and fittings and undisturbed ground as indicated.
- .3 Keep pipe couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.

4.11 PIPE BACKFILLING

- .1 Do backfilling work in accordance with Section 02223 - Excavating, Trenching and Backfilling.
- .2 Lay continuous runs of warning tape on top of surround material at the distance indicated directly above water and sewer mains.
- .3 Surround and cover pipes between joints when pipe laying is complete and inspected by the Owner.
- .4 Protect pipe from freezing if temperatures lower than minus 5 degrees C.
- .5 Surround and cover joints and fittings with surround material placed and compacted as specified when testing results are accepted by the Owner.

- .6 Place backfill material above pipe surround, in uniform layers not exceeding 150 mm compacted thickness.
- .7 Mechanically compact each layer to at least 95% maximum dry density in accordance with ASTM D698 and corrected as specified in Section 02501 – Corrected Maximum Dry Density.

4.94.12 TESTING

- .1 Flush, disinfect, and test water mains for leakage in accordance with Section 02713 – Water Mains.
- .2 Leakage test sewage force mains in accordance with Section 02724 – Sanitary Sewerage Force Mains Piping.
- .3 Field test sanitary sewers for infiltration and exfiltration in accordance with Section 02702 – Public Sanitary Sewerage Gravity Piping.
- .4 Test water mains, force mains, and sanitary sewers for obstructions using "pig" test.
 - .1 Provide labour, tools, ropes, pigs and other equipment necessary to examine all work as required by the Owner.
 - .2 Unobstructed pipes: when wood or metal ball, having diameter 19 mm less than inside diameter of pipe can be readily pulled through pipe line.
 - .3 Repair or replace mains which do not pass pig test.
 - .4 If O-ring connections are used, provide temporary thrust blocks prior to hydrostatic pressure testing of piping system.
 - .5 Place bedding and backfill around center portion of piping system, leaving thrust blocks and field joints clear for observation.
 - .6 After successful completion of hydrostatic pressure test cast concrete thrust blocks.
- .5 After completion of repair work, redo leakage, infiltration and exfiltration tests.
- .6 Electric heat tracing to be tested in accordance with cable suppliers instructions.
- .7 Protect piping from freezing if testing at temperatures lower than 0 ° C.

4.13 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01710 – Reinstatement and Cleaning.
 - .1 Leave Work area clean at end of each day.

.5.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01710 - Reinstatement and Cleaning.

PART 5 PAYMENT

5.1 MEASUREMENT FOR PAYMENT

.1 Measure Water main in metres of each size of pipe installed.
.1 Make horizontal measurement over surface, through valves and fittings, after work has been completed.
.2 Measure lateral connections from water main to hydrants as water main and will include curb valve and adjustable valve box.
.2 Measure hydrants in units installed.,-hydrants,
.3 Measure service connections in metres of each size of pipe installed
.4 Measure, valves in units installed.and
.5 Measure valve chambers in units installedwill be measured in accordance with Section 02713.
.6 Measure sanitary sewer horizontally from maintenance hole to maintenance hole in metres of each size of pipe and depth class installedwill be measured in accordance with Section 02702.
.7 Measure Sewage force main in metres of each type and size of pipe incorporated into the Workwill be measured in accordance with Section 02724.
.1 Take measurement of actual length in place, through valves and fittings, after Work has been completed.
.8 Testing will not be measured for payment.

5.2 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.
.2 Payment will be made to the maximum of 90 % of the value of water mains, sewer mains, force mains, hydrants, valves, fittings and appurtenances until the system, or sections of the system if payment approved by the Owner, has passed all specified tests. The 10 % retained shall be the specified testing allowances.

- .3 Trenching and backfilling will be measured in accordance with Section 02223 – Excavating, Trenching and Backfilling.
- .4 Granular bedding and surround material will be measured in cubic metres in accordance with Section 02223.
- .5 Concrete for bedding, encasement of pipes, supports and thrust blocks will be measured in accordance with Section 03300 – Cast-in-Place Concrete.

Not For Construction