



B - TECHNICAL REQUIREMENTS

**SPECIFICATION FOR
ORIENTED UNPLASTICIZED POLYVINYL CHLORIDE
(PVC-O) PIPE FOR WATER CONVEYANCE SYSTEM**

**SPECIFICATION SAJ TR/PVCO/001
(Rev.1.0 / 12.2018)**

QUALITY ASSURANCE DEPARTMENT
RANHILL SAJ SDN. BHD.

Ref. No. : TR/PVCO/001
Date : 24/12/2018
Total Pages : 9/9

Approve by: 
Ass General Manager Quality Management

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Specification for Oriented Unplasticized Polyvinyl Chloride (PVC-O) Pipe for Water Conveyance System

1.0 General

- 1.1** All PVC-O pipes, specials and fittings must be from SAJ approved sources and be to SAJ specification.

2.0 Scope

- 2.1** This technical requirement covers the safety, handling, installation, testing and maintenance aspects relevant to PVC-O pipes.

3.0 Health Safety and Environment

- 3.1** The SAJ shall ensure all personnel, Contractor, installer and others parties at site shall be adhere to the safety standards and Personal Protective Equipment (PPE) shall be worn.
- 3.2** The SAJ shall be clearly identify and locate all underground lines, equipment and electrical cables prior to commencement of work especially for all trenching and excavation work.
- 3.3** Contractor shall aware of the traffic at site and all requirements of traffic management system shall be applied.
- 3.4** All the basic precautions shall be adhere.

4.0 Pipe Storage

- 4.1** Pipes shall be stored on a firm, flat surface and dry, free from high winds and any other potential which may cause damage.
- 4.2** Pipes shall be stacked in properly and safe to protect from deformation occur to the pipes in the lower layers, particularly during warm weather and shall be stacked using wooden crates.
- 4.3** At all times pipes shall be stored away from exhaust outlets and all other high temperature sources. Pipes shall be properly cover up to protect from ultraviolet radiation. Pipes shall be delivered with its rubber gasket installed within socket groove. Care shall be taken to avoid contact with grease, oil solvents, petrochemical products and other aggressive chemicals.
- 4.4** The pipe storage areas shall be provided with adequate access for construction vehicles and/or lifting equipments.

5.0 Handling and Transportation

- 5.1** For transportation bulk loads, the vehicle used shall be provided with a clean flat bed, free from nails or other hard projections which may cause damage. If trailers are used, special care shall be taken to prevent slippage of the pipe. The crates shall be stacked on top of each other not exceeding three crates for DN90 mm to DN250 mm and four crates for DN315 mm to DN630 mm for each delivery. All sharp edges shall be adequately padded up.
- 5.2** Prior to unloading of pipes from trailers, all items shall be inspected. If at any time during handling or installation of pipe, any damage shall be marked as scrap/defect.
- 5.3** Single pipes shall be unloaded and handled separately one at a time by using pliable straps, slings or ropes. Care shall be taken to prevent pipes from rolling or falling from flat bed trailer by using proper supports, chocks.

6.0 Trench Excavation

- 6.1** Prior to any excavation works, the route of the trench shall be pegged out accurately and the existing ground levels shall be agreed by SAJ. Strong sight rails shall then be fixed and maintained at each change of gradient and at as many intermediate points as may be necessary. The rails shall remain until backfilling of the trench is completed.
- 6.2** The trench sides shall be supported if external loads or high water table are likely to be present and affected the stability of the trench even if the depth is less than 1.2 m. Where the water table is high and affected the base of the trench excavated, the trench shall be excavated 250 mm below the level intended and brought back to the correct level with selected earth or sand compacted firmly on to the base.
- 6.3** Trench excavation shall be performed as far away as possible from the crest or toe of an engineered slope or retaining structure.

7.0 Pipe Laying and Jointing

- 7.1** All pipes shall be laid at locations which are readily accessible for carrying out maintenance works and where the repair and rehabilitation works can be carried out economically.
- 7.2** Pipes shall be laid to minimum gradient of 1 on 500. Where the gradient of a pipeline is 1 on 20 or steeper, pipes shall be laid on an ascending gradient starting from low point and finishing at the high point.
- 7.3** Prior any pipe and special is lowered into the trench, it shall be inspected by SAJ for cracks and flaws both internally and externally. All materials shall be free from any deep cuts or scratches which are deeper than 10% of wall thickness. Materials found to be damaged in any way shall be shown to the S.O who will give instructions regarding remedial work or otherwise.
- 7.4** The trench bottom shall be free from all rock, boulders, stones or hard particles which may cause damage to the PVC-O pipes. The trench shall be bedded as shown on the drawings.
- 7.5** No pipes shall be rolled into place for lowering into the trench. For PVC-O pipes less than/or 70kg, it shall be fully handled with manual, minimum of two (2) persons to supports per length of pipe. For pipes more than/or 90kg, the pipes shall be lowered into the trench by using slings or ropes or by other means acceptable to the Engineer. Wire ropes, chain and hooks shall not be permitted to come in contact with external pipes.
- 7.6** After laying, the interior of pipes or specials shall be carefully cleaned to remove any debris, dirt, stones or other matter that may have entered during laying.
- 7.7** Under all circumstances, water pipes shall not be laid below sewers. A minimum vertical clearance of 1.0 metre shall be provided between the crown of a sewer pipe and the bottom of a water pipe. The minimum horizontal clearance between sewer and water pipelines shall be 3.0 metres. When applicable, water pipes shall be installed on the opposite side of the carriageway in relation to sewers installed along the same road. The pipe shall be laid a minimum of 600mm away from any other utilities and also from drain.

8.0 Trench Backfilling

- 8.1** Only approved materials free from stones or rocks or other hard materials shall be spread along the trench bottom between the pipes and the trench walls to a depth of about 150 mm and shall be hand rammed. Further layers each of about 150 mm thick of the same materials shall be spread and rammed in the same manner up to the top of the pipes. Care shall be taken to ensure the backfill material completely fills voids between the bottom section of pipes and the bedding.
- 8.2** The remainder of the backfilling may consist of coarse materials free from boulder and clods and it shall be placed in layers each of 150 mm thickness and hand or mechanically rammed until the backfill is 300 mm above the top of the pipes. The rest of the trench backfill shall be in layers each of 300 mm thickness and compacted by a mechanical vibrating tamper to finish off slightly proud of the surrounding ground.
- 8.3** Approved fill material to be used as backfill to the top of the pipes will be uniform low plasticity granular material. The material shall be free from all organic or other materials subject to decay. Highly plastic or expansive soils or clay shall be not be used. The filling material shall be readily compactable to its maximum density and must not form mud or otherwise breakdown when wet.

9.0 Disinfection and Flushing of Pipeline

- 9.1** The pipeline to be sterilized shall be filled with water mixed with a solution of chloride of lime containing about 40 milligrams per litre (40ppm) of chlorine. The system shall be provided with a set up of temporary equipment, chemical mixing tank mixer, dosing pump and other necessary accessories for the solution to be injected into the lines when potable water shall be introduced gradually. After the main has been filled with chlorinated water, it shall be isolated and left for a minimum of 24 hours. The pipeline is deemed sterilized if the samples of water taken from various tapping on the pipeline show chlorine residual of 10 ppm after 24 hours.
- 9.2** Flushing shall be carried out after disinfection is achieved. Water sources used for flushing shall be clean and treated. Flushing of pipeline shall be deemed complete only when the following conditions are met.

Table 1 Flushing Parameter

Parameter	Value
Turbidity	< 2 NTU
pH	< 9.0
Chlorine (Residual)	> 0.2 ppm
E.Coli and Total Coliform	Nil

10.0 Field Testing (Hydrostatic and Leak Testing)

10.1 Pressure Test

10.1.1 The test pressure to be applied shall be 16 bars at lowest point for PVC-O PN 16 and 25 bars for PVC-O PN25.

10.2 Leak Test

10.2.1 In testing, the main shall be filled with clean water and properly vented to remove trapped air. After a period of 24 hours, the pressure shall be raised by pumping to the specified test pressure. Pumping shall then cease at 10 bar and after a period of 24 hours, pumping shall be resumed and the quantity required to be pumped, in order to restore the test pressure, divided by the time, shall be the measure of the rate of loss.

10.2.2 The length of main under test shall be deemed to have passed the test if the leakage does not exceed 0.1 litre per mm of internal diameter per 24 hour per kilometre of pipeline per 30 m of water pressure.

Table 2 Hydrostatic and Leak Testing

Pipe Class	Maximum Allowable Working Pressure	Max. Target Pressure for Hydrostatic Test	Target Pressure for Leak Test
PN 16	16 bars	16 bars	12 bars
PN 25	25 bars	25 bars	12 bars

11.0 Repair

11.1 The method of repairing the section of the damaged pipe shall depend on the nature of the damage.

11.2 Three (3) types of methods covered in this section are;

a) Repair Clamps

This repair method is meant for PVC-O pipes that have damaged sections in the form of tear, fracture, rupture or crack of relatively small in size and shall not propagate in to a larger damage.

b) Pipe Couplers

This repair method is meant for PVC-O pipes that have damaged sections in the form of tear, fracture, rupture or crack of sizes too big for repair clamps and the crack section is to be cut and replaced with a new section of PVC-O pipe of the same size and rating.

c) Flange Adaptor/High Tolerance (Stepped) Couplers

This repair method is meant for PVC-O pipes that have damaged sections in the form of tear, fracture, rupture or crack of sizes too big for repair clamps and the crack section is to be cut and replaced with a new section of pipe with a different material and outer diameter.

All methods of repair shall follow the procedures.

11.3 Procedure Using Repair Clamps.

- 11.3.1 Ensure the main isolation valve is shut off.
- 11.3.2 Drain the effected section of line.
- 11.3.3 Clean all around pipe where clamp is to be installed.
- 11.3.4 Measure and check diameter of pipe against tolerance of fitting.
- 11.3.5 Select clamp wide enough to cover the leaks.
- 11.3.6 Open the clamp and place it on the pipe next to the leak.
- 11.3.7 Hook the clamp together and slide it over the leak.
- 11.3.8 If clamp has more than one bolt, tighten bolts evenly.
- 11.3.9 Leak test to ensure leakage has been stopped.
- 11.3.10 Re-open the main isolation valve.

11.4 Procedure Using Pipe Couplers.

- 11.4.1 Ensure the main isolation valve have been shut off.
- 11.4.2 Drain the effected section of line.
- 11.4.3 Clean all around the sections of pipe required for cutting.
- 11.4.4 Measure pipe diameter and select coupler to the affected pipe.
- 11.4.5 Cut the damaged section of the pipe and bevel the edges.
- 11.4.6 Mount the couplers on each affected/cut ends.
- 11.4.7 Insert the replacement pipe in to the cut section and slide the couplers over the mating section of the replacement and existing pipes.
- 11.4.8 Tighten the bolts on the couplers evenly.
- 11.4.9 Leak test to assure leakage has been stopped.
- 11.4.10 Re-open the main isolation valve.

11.5 Procedure Using Flange Adaptors / High Tolerance (Stepped) Couplers.

- 11.5.1 Ensure the main isolation valve have been shut off.
- 11.5.2 Drain the effected section of line.
- 11.5.3 Clean all around the sections of pipe required for cutting.
- 11.5.4 Measure pipe diameter and select coupler to fit the affected pipe.
- 11.5.5 Cut the damaged section of the pipe and bevel the edges.
- 11.5.6 Mount the couplers on each affected/cut ends.
- 11.5.7 Insert the replacement pipe in to the cut section and slide the couplers over the mating section of the replacement and existing pipes.
- 11.5.8 Tighten the bolts on the couplers/adaptors evenly.
- 11.5.9 Leak test to assure leakage has been stopped.
- 11.5.10 Re-open the main isolation valve.

12.0 Marking

12.1 All pipes shall be visibly marked on the outside as follows;

- Nominal diameter and material classification
- Nominal pressure
- Name of manufacturer and brand/trade mark
- Batch number and year of manufacture
- Reference standard and certification license
- C-factor
- Production site
- Initial SAJ in capital letter