DELHI METRO RAIL CORPORATION LIMITED

DMRC ELECTRICAL STANDARDS & DESIGN WING (DESDW)

SPECIFICATION NO.
DMES-E/0011/ DMRC-E-E&M-PFFS-01

SPECIFICATIONS FOR PIPING FOR FIRE FIGHTING SYSTEM

Issued on:

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DELHI METRO RAIL CORPORATION LTD.
7th Floor, B-Wing, Metro Bhawan, Fire Brigade Lane,
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Specifications For Piping for Fire Fighting System

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1. **Detailed description and Application in DMRC**

   The scope of work covers supply, fabrication, laying, testing, painting and commissioning of the entire piping system for the fire fighting installation i.e. fire hydrant and sprinkler systems.

2. **Governing Specifications**

2.1 The following standards shall be applicable:

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<tr>
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<td>IS: 554 – 1999</td>
<td>Dimensions for pipe threads where pressure tight joints are required on the threads.</td>
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<td>ii.</td>
<td>IS: 638 – 1979</td>
<td>Sheet rubber jointing and rubber insertion jointing.</td>
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<td>iii.</td>
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<td>Copper alloy gate, globe and check valves for water work purposes.</td>
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<td>iv.</td>
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<td>Couplings, double male and double female, instantaneous pattern for fire fighting</td>
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<td>v.</td>
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<td>Mild steel tubes, tubulars and other wrought (Part I &amp; II) steel fittings.</td>
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<tr>
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<td>Landing valves</td>
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<td>x.</td>
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<td>Code of practice for coating and wrapping of underground mild steel pipelines</td>
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<tr>
<td>xii.</td>
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<td>Rules for Automatic sprinkler installation &amp; Tariff Advisory Committee</td>
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<tr>
<td>xiii.</td>
<td>IS: 1879 – 1987</td>
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<td>IS: 1538 – 1993</td>
<td>Cast iron fittings for pressure pipes for water, gas and sewage</td>
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<td>xvi.</td>
<td>IS: 7181 - 1986</td>
<td>Horizontally cast iron double flanged pipes for water, gas and sewage</td>
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2.2 All the standards mentioned above as well as referred to in the document elsewhere shall be latest.

### Requirements

3. **Hydrant Mains**

3.1 **External**

3.1.1 Mild steel pipes, when laid underground, shall be protected against corrosion by a 4 mm thick bituminous tape with minimum 12 mm overlap over the entire length including fittings. Fittings shall be weldable wrought iron; suitable for butt-welding and 10% of the welded joints shall be radiographically tested and found in order. The welded joints shall be random selected for testing in consultation with the Engineer-in-charge. All flanges shall be slip-on welded type to IS: 6392 – 1971 with a 3mm fiber-reinforced EPDM gasket and rated for 2.0 N/ mm².
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3.1.1.2 Underground mains shall be laid not less than 750 mm below the ground level. All excavation for pipe laying shall be carried out with sufficient width for making proper joints. Backfilling shall be done only after the piping is hydro-statically pressure tested. Piping shall be constantly kept clean till tested.

3.1.1.3 All valves shall be housed in brick masonry chambers over 150mm cement concrete (1:3:6) foundation. The brick walls of the chamber shall be plastered inside and outside with 20mm cement sand plaster 1:4 with a floating coat of neat cement. Chambers shall be 650 x 650 mm clear for depths up to 1200 mm and 1000 x 1000 mm for depths beyond. Each chamber shall have a cast iron surface box approved by the Engineer in charge.

3.1.1.4 Piping laid above ground shall be supported on cement concrete (1:2:4) pedestals raising the bottom of the pipe at least 150mm over the ground level and held to the pedestals with galvanized clamps. Pedestals shall be made at 3.0m centre to centre and as shown on drawings. Cement concrete 1:2:4 thrust anchors shall be provided at all tee-off points and change of direction as shown on drawings and as required. Pipes laid on walls and ceiling shall have galvanized steel brackets.

3.1.2 Internal

3.1.2.1 All internal pipes shall be, unless otherwise specified, heavy quality mild steel tubes to IS: 1239 using wrought steel heavy-duty fittings. Flanges shall be provided to mate with valves and other equipment and shall conform to IS: 6392. Flanges shall be rated for 2.0 N/mm².

3.1.2.2 Valves shall be suitable for external piping.

3.1.2.3 All pipes shall be of approved make and best quality without rust marks. Pipes and fittings shall be fixed in a manner as to provide easy accessibility for repair, maintenance and shall not cause obstruction in shafts, passages etc. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanship manner. Pipes shall be securely fixed to walls and ceilings by suitable supports at intervals specified. Only approved type of anchor fasteners shall be used for RCC
 Specifications For Piping for Fire Fighting System

ceiling and walls.

3.1.2.4 All pipes shall be adequately supported from ceiling or walls through structural supports fabricated from mild steel support structures e.g., rods, channels, angels and flats generally as shown on drawings. Fasteners shall be shear type anchor fasteners in concrete walls and ceilings and wrought steel spikes of at least 75mm long in brick walls. All pipes supports shall be painted with 1 coats of red oxide primer and two coats of black enamel paint.

3.1.2.5 All low point loops in the piping shall be provided with 25mm Ball Valves with rising spindle for draining the system. All valves shall have screwed brass caps. Likewise 25mm gunmetal air vents shall be provided at all high point loops to prevent air locking.

3.1.2.6 All piping shall have flanged joints at about 25m intervals to facilitate easy maintenance.

3.2 Pipe Jointing

3.2.1 All pipes shall be provided with threaded / welded joints. Hold tite shall be used for sealing for threaded joints.

3.2.2 Joints between valves and MS pipes shall be made by providing a suitable flange. Flanges shall have appropriate number of holes and shall be fastened with nuts, bolts and 1.5mm thick EPDM gasket.

3.3 Valves and other accessories

3.3.1 Gate Valves

3.3.2 Sluice / Gate valves shall be used for isolation of flow in pipelines. For sizes up to 85 mm, gate valves shall be outside screw non rising spindle type and shall be as per IS: 778 Class-I and Class-II, as applicable. For sizes 80 mm to 300 mm, gate valve shall be as per relevant IS, PN=1.6 and shall be of inside screw and non rising type and cast iron double flanged.
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3.3.3 Gate valves shall be provided with a hand wheel, draining arrangement of seat valve and locking facility (as required). Gate valves shall have back setting bush to facilitate gland renewal during full open condition.

3.3.4 The Body, bonnet, Stuffing Box, cap and hand wheel shall be of cast iron to IS: 210 - 1970, grade FG 200 / 260. The non-rising spindle shall be of solid forged high tensile brass or carbon steel to AISI 304 construction. The Body seating and wedge ring shall be of solid leaded gunmetal. The Bonnet gasket shall be of high quality rubber.

3.3.5 The Valve shall be PN 1.6 rated but shall withstand tests of up to 20 kg / cm². The ends shall be flanged. The batch number of the valve shall be punched on the top of the flange. The spindle shall be removable type, and shall be easily rotated.

3.4 Pressure Switch

3.4.1 The Pressure switches shall be employed for starting and shutting down operation of pumps automatically, dictated by line pressure. The Pressure Switch shall be diaphragm type. It shall be suitable for line pressures up to 15 kg / cm². The scale range for cut in and cut out shall be from 0 to 10 kg / cm².

3.4.2 The Switch shall be suitable for consistent and repeated operations without change in values. It shall be provided with IP: 66 water and environment protection.

3.4.3 The enclosure shall be of aluminium and pressure element and wetted parts shall be of stainless steel. The switch shall be snap acting type with 1 number NO / NC contact.

3.5 Air Vessel and Air Release Valve

3.5.1 Air vessel shall be fabricated from 6 mm thick, 300mm x 1000mm MS plate suitable for 7kg/cm² working pressure complete with air release valve, safety valve, pressure gauge etc. as required. The air vessel shall be continuous welded construction and painted with two coats of Postal red enamel outside over a coat of primer and epoxy paint inside.

3.5.2 Air Release Valve shall be gun metal and minimum test pressure of 20 bar.
3.6 Pressure Vessel

3.6.1 The Pressure Vessel shall be provided to compensate for slight loss of pressure in the system and to provide an air cushion for counter acting pressure surges whenever the pumping set comes into operation. It shall be normally partly full of water, the remaining being filled with air, which will be under compression when the system is in normal operation.

3.6.2 Pressure vessel shall be fabricated from 8-10 mm thick MS plate with dished ends and suitable supporting legs. It shall be provided with a 50 mm diameter flanged connections from pump, one 25 mm drain with ball valve, one water level gauge and 25 mm sockets for pressure switches. The pressure vessel shall be hydraulically tested as required.

3.6.3 The Pressure Vessel shall be for Hydrant Systems. The Pressure Switches shall be mounted on the drain end of each Vessel. The Vessel shall also be provided with an air release valve mounted at the top.

3.7 Pressure Gauge

3.7.1 The Pressure Gauge shall be constructed of die cast aluminium and stove enameled. It shall be weather proof with an IP 55 enclosure. It shall be a stainless steel Bourden tube type Pressure Gauge with a scale range from 0 to 15 Kg/cm² and shall be constructed as per IS: 3624 - 1987. Each Pressure Gauge shall have a siphon tube connection. The Shut off arrangement shall be by Ball Valve.

3.8 Ball Valve

3.8.1 The Ball Valve shall be made from die cast brass and tested to 14 Kg/cm² pressure. The valve shall be internally threaded to receive pipe connections.

3.8.2 The Ball shall be made from brass and machined to perfect round shape and subsequently chrome plated. The seat of the valve body- bonnet gasket and gland packing shall be of Teflon.

3.8.3 The handle shall be of chrome-plated steel with PVC jacket. The handle shall also
Specifications For Piping for Fire Fighting System

indicate the direction of 'open' and 'closed' situations. The gap between the ball and the teflon packing shall be sealed to prevent water seeping up to 14 Kg / cm² pressure.

3.8.4 The handle shall also be provided with a lug to keep the movement of the ball valve within 90 degree. The lever shall be operated smoothly and without application of any unnecessary force.

3.9 Non Return Valve

3.9.1 Non-return valves shall be cast iron spring action swing check type. An arrow mark in the direction of flow shall be marked on the body of the valve. The valve shall bear IS certification.

3.9.2 The Valve shall be of cast iron body and cover. The internal flap in the direction of water shall be of cast iron and hinged by a hinge pin of high tensile brass or stainless steel. Cast iron parts shall conform to IS: 210 – 1970, grade 200 / 280 type.

3.9.3 The gasket shall be of high quality rubber and flap seat ring of leaded gunmetal. At high pressure of water flow the flapper shall seat tightly to the seat. The Valve shall be capable of handling pressure up to 15 kg / cm².

3.10 Butterfly Valve

3.10.1 The Butterfly Valve shall be suitable for waterworks and tested to minimum of 16 kg / cm² pressure. The Valves shall fulfill the requirements of IS 13095.

3.10.2 The body shall be of cast iron to IS: 210 in circular shape and of high strength to take the minimum water pressure of 10 kg / cm². The disc shall be heavy-duty cast iron with anti corrosive epoxy or nickel coating.

3.10.3 The valve seat shall be of high-grade elastomer or nitrile rubber. The Valve in closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomer rubber shall have a long life and shall not give away on continuous applied water pressure. The shaft shall be of EN 8 grade carbon steel.
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3.10.4 The Valve shall be fitted between two flanges on either side of pipe flanges. The Valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakage.

3.10.5 The Valves shall be supplied with manual gear operated opening / closing system by lever.

3.11 Pipe supports

3.11.1 All pipes whether horizontal or vertical shall be suitably supported using GI clamps / painted MS angles as approved by Engineer in Charge.

3.11.2 Vertical Pipes

3.11.2.1 The pipes running vertical shaft shall be supported by galvanized mild steel rigid clamps fixed to wall with anchor bolts and studs.

3.11.3 Horizontal Pipes

3.11.3.1 Pipes running horizontal shall be supported from structural beam/slab by using appropriate GI clamps / MS angles with anchor fastener, bolts etc as approved by Engineer in Charge.

3.11.4 The spacing of supports shall be as follows:

<table>
<thead>
<tr>
<th>GI Pipes/MS Pipes</th>
<th>Cl Spun Pipes</th>
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<tbody>
<tr>
<td><strong>Internal Dia (mm)</strong></td>
<td><strong>Spacing (mm)</strong></td>
</tr>
<tr>
<td>15</td>
<td>1800</td>
</tr>
<tr>
<td>20,25</td>
<td>2400</td>
</tr>
<tr>
<td>32</td>
<td>2700</td>
</tr>
<tr>
<td>40-50</td>
<td>3000</td>
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<table>
<thead>
<tr>
<th>Size</th>
<th>Maximum Pressure</th>
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<tr>
<td>65-80</td>
<td>3600</td>
</tr>
<tr>
<td>100</td>
<td>4000</td>
</tr>
<tr>
<td>150</td>
<td>4500</td>
</tr>
</tbody>
</table>

3.11.5 Supports for horizontal piping longer than 15m in a stretch shall be provided with swivel clamps. Otherwise, the clamps shall be universal clamps or rigid clamps as required by the project engineer-in-charge.

3.11.6 Fixing of clamps/rails etc. - All clamps, rails and accessories shall be fixed to the structure (beam, slab, walls etc.) by using approved good quality anchor fasteners of appropriate size.

3.12 Painting

3.12.1 All exposed piping for fire fighting shall be distinctly painted 'Fire red' shade 536 to IS: 5-2004. Pipes shall first receive two coats of red oxide primer uniformly applied and two coats of oil paint applied thereafter. All pipes supports shall be painted black as specified for support & clamps.

3.12.2 Painting Schedule - All equipment and piping shall be painted in accordance with the following colour code:

<table>
<thead>
<tr>
<th>SN</th>
<th>Equipment</th>
<th>Colour</th>
<th>Distinguishing Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Pump motors</td>
<td>Fire Red Shade</td>
<td>No.536 to IS: 5-2004</td>
</tr>
<tr>
<td>b.</td>
<td>Internal piping</td>
<td>- do -</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>Landing valves &amp; Hose reel cabinets</td>
<td>- do -</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>External Hydrants</td>
<td>- do -</td>
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<tbody>
<tr>
<td>e.</td>
<td>Fire brigade connection - do -</td>
</tr>
<tr>
<td>f.</td>
<td>Priming tank - do -</td>
</tr>
<tr>
<td>g.</td>
<td>Air vessel - do -</td>
</tr>
<tr>
<td>h.</td>
<td>Electric panels Black &amp; Red</td>
</tr>
<tr>
<td>i.</td>
<td>Fire Alarm Panel Black &amp; Red</td>
</tr>
<tr>
<td>j.</td>
<td>Repeater panel Black &amp; Red</td>
</tr>
<tr>
<td>k.</td>
<td>Break Glass Unit Fire Red</td>
</tr>
<tr>
<td>l.</td>
<td>Hooters/Speakers Fire Red</td>
</tr>
<tr>
<td>m.</td>
<td>Sprinkler pipes Fire Red</td>
</tr>
</tbody>
</table>

3.12.3 All surfaces to be painted shall be thoroughly cleaned with wire brush to remove completely rust and other extraneous substances. Over the cleaned surfaces one coat of red oxide primer shall be applied completely covering the exposed surfaces. Finishing coat of enamel paint shall be applied one day after the prime coat, after ensuring that the paint is dry. The second coat shall be done before the installation is handed over and after approval to do so from the Engineer-in-charge.

3.13 Makes of materials

For makes of materials refer to list of approved makes of material.

3.14 Mode of measurement

3.14.1 All external piping shall be measured along the centre line of the pipe and paid per unit length and shall include:

a. All pipes & fittings
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b. Bituminous coating

3.14.2 All internal piping shall be measured similarly but shall include for the pipe supports and clamps.

3.14.3 All valves, air valves, drain valves together with flanges or tail pieces shall be measured per unit.

3.14.4 All excavation and concrete supports and thrust blocks shall be measured as per drawing and paid for per cum.

3.14.5 The cost of pipe supports described above form part of the rate quoted for piping and no extra shall be payable on the account.

3.14.6 All painting shall form part of the cost of equipment piping etc. No separate payment shall be admissible.

4. Additional Requirement: None.

5. Safety: None.


7. Maintenance and Life: N.A.

8. Material and manufacturing

8.1 Quality Assurance and Controls: The Contractor's Management Systems shall emphasize quality assurance and controls. The programme shall be adequate to ensure an acceptable level of quality of the equipment supplied. The concept of total quality assurance shall be based on the principle that quality is a basic responsibility of the Contractor's organization, and shall be visible by:

1. Firm procurement and job performance specifications.
2. Firm procedures for transmission of information and data to their Subcontractors and ensuring their compliance.
3. Adequate testing to ensure repetitive product conformity to design requirements and Total programme of surveillance and verification of physical performance and configuration accountability.
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4. Adequate records shall be kept by the Contractor to provide evidence of quality and accountability. These records shall include results of inspections, tests, process controls, certification of processes and personnel, discrepant material, and other quality control requirements.

5. Complaint Handling and commitment towards customer satisfaction.

9. Testing

9.1 All piping after installation shall be tested for a hydrostatic test pressure of 10.5 kg/cm² or 1.5 times the working pressure (whichever is less) maintained for 24 hours. All joints and valves shall be checked for leaks and rectified and retested. During testing all valves except drain & air valves shall be kept fully open.

10. Training

10.1 The contractor shall ensure training of DMRC staff as decided by DMRC at DMRC workplace or at his workplace as considered necessary.

10.2 On completion of installation, the manufacturer shall supply two sets of well bound handing over manuals duly approved by Consultants/Engineer-in-charge. Each set shall include:

- As Built Drawings.
- Do's and Don'ts for the maintenance and operating staff.
- Working details of piping of Fire Hydrant system.
- Operating manual.
- Extracts of the warrant/DLP.
- Details of service center.
- List of staff trained on the said design of the piping of Fire Hydrant system.
- The first page of the booklet shall be signed by the manufacture, contractor and DMRC Engineer.
- Soft copy of the entire documents.