

**CITY OF WHITEHORSE SERVICING STANDARDS MANUAL**  
**PART 3 – CONSTRUCTION SPECIFICATIONS**  
**SECTION 3.6 – FORCE MAINS**

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## **SECTION 3.6 – FORCE MAINS**

### **3.6.1 SCOPE**

The work described in this sub-section pertains to the installation of force main piping and appurtenances and connection to existing mains.

### **3.6.2 MATERIALS**

All materials used are to be of the manufacture stated on the plans and in these specifications.

All work described in this section is to be carried out in strict accordance with manufacturer's recommendations unless otherwise noted.

#### **3.6.2.1 BEDDING SAND**

The bedding sand, free from organic material, is to meet the grading requirements specified in 3.5.2.1.

#### **3.6.2.2 BEDDING STONE**

Bedding stone is to be used when wet trenching conditions exist.

The bedding stone, free from organic material, is to meet the grading requirements specified in 3.5.2.2.

All force main pipes are to be bedded on a 150 mm layer of sand or stone, which are to be continued up to a level 300 mm above the crown of the pipe for the full width of the trench. Coupling holes are to be provided and the barrel of the pipe is to be evenly supported throughout its entire length. All bedding sand or stone is to be compacted to a minimum of 95% Standard Proctor Density at optimum moisture content.

#### **3.6.2.3 FORCE MAINS AND FITTINGS**

Pipe for the force main is to be either high-density polyethylene pressure pipe (HDPE), ductile iron pipe (DI) or polyvinyl chloride (PVC) and is to conform to the standards in Section 2.3.3.

#### **3.6.2.4 INSULATION**

Insulation of force mains are to be as specified in Section 2.3.5.

#### **3.6.2.5 VALVES**

Gate valves are to conform to Section 2.3.7.2 Gate Valves.

Force main valves are to be located such that interruption to residents is minimized during a shutdown.

Cleanouts are to be situated along the length of the force main and are to be installed at low points on the profile. Cleanouts are to be designed as per detail in Section 4.

#### **3.6.2.6 CONCRETE**

All concrete is to conform to section 3.5.2.7.

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### **3.6.3 INSTALLATION**

#### **3.6.3.1 LAYING**

The pipe is to be laid true to the line, grade, and depth as per Sub-section 3.4, Trenching and Backfilling. Where minor deflections in line or grade are required, the deflections are not to exceed half the maximum recommended by the pipe manufacturer. Pipe is not to be laid in water or in unsuitable trench conditions.

#### **3.6.3.2 JOINTS**

Wherever possible the polyethylene pipe should be joined by the method of thermal butt-fusion, as outlined in ASTM-D2657, Joints Heat Joining Polyethylene Pipe and Fittings. Butt-fusion joining of pipe and fittings is to be performed in accordance with procedures recommended by the manufacturer.

#### **3.6.3.3 BEDDING AND INITIAL BACKFILL**

All force main bedding is to conform to section 3.5.3.3.

#### **3.6.3.4 INTERRUPTION OF UTILITY SERVICES**

The Developer without approval of the Engineer and the utility concerned are to operate no valve, switch, or other control on existing utility systems for any purpose.

#### **3.6.3.5 APPURTENANCES**

The Developer is to install all valves, fittings, air release manholes, blow off valves, flushouts and other appurtenances at the locations shown on the construction drawings or as directed by the Consultant. Installation is to be in accordance with the standard drawings in Section 4 for each appurtenance. Appurtenances, which have movable parts, are to be thoroughly examined and operated by the Developer before installation, and they are to satisfy themselves that they operate properly and are without visible defect.

All valves, when closed or open position, are to be suitable for a working pressure of 1000 KPa and are to safely withstand a pressure of 2000 KPa.

#### **3.6.3.6 REACTION BLOCKING**

All reactive blocking is to conform to section 3.5.3.5.

#### **3.6.3.7 CONNECTION TO EXISTING MAINS AND MANHOLES**

The Developer is to make all necessary connections to existing force or gravity mains as per section 3.5.3.6.

The Developer is to break into existing Manholes or sewers, after covering existing channels to prevent debris from entering the system. All connections into manhole or sewer mains must be grouted/sealed to ensure there will be no infiltration/exfiltration

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### **3.6.4 TESTING**

#### **3.6.4.1 PRESSURE TEST**

Before acceptance of the work, the entire system is to be subject to a hydrostatic pressure test in the presence of the Consultant. The Developer is to provide all necessary labour, materials and equipment for the test, including a suitable pump, measuring tank, pressure hoses, connections, plugs, caps, gauges and all other apparatus necessary for filling the main, pumping to the required test pressure and recording the pressure and leakage losses. The Developer is to provide evidence that the gauges used are accurate.

The system is to be filled with water slowly and air-bled off by installing temporary bleeder valves. At the completion of testing, these taps are to be satisfactorily plugged. When the line has been filled and most of the air expelled, time should be allowed for the remaining air and water to reach a constant temperature. The test section may be pressured through a tap installed in the line. After testing, the pipe is to be plugged.

The mains, or applicable sections of mains, are to be subject to a pressure of 50% greater than the rated pressure of the pipe at the lowest elevation of the system. Test sections are not to exceed 450 meters of main unless otherwise approved by the Engineer. When, in the opinion of the Consultant, local conditions are such that the trenches must be backfilled immediately after laying the pipe, the tests may be made after backfilling has been completed, but before placement of permanent paving.

The hydrostatic testing is to be conducted as follows:

1. Maintain a flow velocity at less than 0.60 m/sec.
2. Expel air completely from the main during filling and again before applying test pressure. All air is to be expelled by means of taps at points of highest elevation.
3. The test procedure itself is to consist of two steps:
  - In order to accommodate the initial expansion of the pipe, sufficient make-up water is to be added to the system at hourly intervals for 3 hours.
  - When the initial expansion process is completed, maintain pressure for a maximum of 2 hours. At the end of this period, add a measured amount of make-up water to the system to return the main back to the original test pressure.
4. The amount of make-up water is not to exceed the allowance for expansion in litres per 30.0 meters of pipe at 23 degrees Celsius.

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<b>ALLOWANCE FOR EXPANSION UNDER TEST PRESSURE ALLOWANCE FOR EXPANSION (LITRES PER 30M OF PIPE) AT 23 DEGREES CELSIUS</b>			
Nominal Pipe Size (mm)	1 Hour Test	2 Hour Test	3 Hour Test
75	0.38	0.57	0.95
100	0.49	0.95	1.52
150	1.14	2.28	3.41
200	1.89	3.79	5.69
250	2.65	4.93	7.96
275	3.79	7.58	11.75
300	4.17	8.72	12.89
350	5.30	10.23	15.92
400	8.33	12.51	18.93
450	8.33	16.29	24.63
500	10.23	20.84	30.31
550	13.26	26.52	39.78
600	17.05	33.72	50.39
700	20.84	42.06	63.27
800	26.52	54.18	85.24
900	34.10	68.19	102.29
1000	41.67	83.35	125.02

The total hydrostatic test is not to exceed eight consecutive hours at 1.5 times the pressure rating. If the initial test is not completed due to leakage, equipment failure, or other reasons within the specified 8 hours, the test section is to be permitted to relax for the next consecutive 8 hours before starting the next sequence of tests.

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If any test of the main requires more make-up water than the allowance specified, the Developer is to locate and repair the cause of the leakage and retest the line. All visible leaks are to be repaired regardless of the amount of leakage.

The amount of expansion taking place during the pressure testing of Polyethylene pipe is also dependent on the temperature of the pipe during testing. The temperature of the pipe can be taken as the average of the temperature of the water pumped into the pipe and the temperature of the empty pipe immediately before testing (Ambient air temperature).

When testing the pipe temperatures below 23 Degrees Celsius the amount of make-up water should be multiplied by the manufactures correction factor.

#### **3.6.4.2 CLEANING THE MAIN**

At the conclusion of the work, the Developer is to thoroughly clean the entire installed main by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the main during the construction period. Ensure that debris does not enter the existing system. The Developer is to remove debris cleaned from the lines from the project site.

#### **3.6.4.3 VALVE TEST**

Each section between valves is to be brought to test pressure and held without loss of pressure for 2 minutes.

#### **3.6.4.4 EXISTING MAINS**

Where connections are made to existing force mains, the pressure used to test sections of the new main that cannot be isolated from the existing mains, is to be specified by the Consultant, or the leakage test may be waived by the Engineer. This does relieve the Developer from their obligation to repair leaks or replace defective material.

#### **3.6.5 MAINTENANCE**

If leaks develop in the work before the expiry of the maintenance period, the Developer is to make the necessary repairs. The leaks are to be deemed repaired when the leakage is less than that allowed.

#### **3.6.6 DAMAGES**

Water introduced into the force mains by the Developer is to be at their own risk. The Developer is to repair all damages to the pipe from freezing or other causes.