

Appendix F
Construction Specifications

1 CLEANSING AND TESTING

1.1 Cleansing of Gravity Sewers, Drains and Manholes

On completion of construction, internal surfaces of sewers, drains and manholes shall be thoroughly cleansed to remove all deleterious matter, without such matter being discharged into existing public sewers or watercourses. The sewers, drains and manholes shall be maintained in a clean and serviceable condition until they are taken in charge as public sewers.

All cleaning and testing shall be the responsibility of the Developer.

1.2 Precautions Prior to Testing Pumping Mains

Before testing any pipeline the Developer shall ensure that it is anchored adequately and that thrusts from bends, branch outlets or from the pipeline ends are transmitted to solid ground, or to a suitable temporary anchorage.

Open ends shall be stopped with plugs, caps or blank flanges properly jointed.

Testing against closed valves will not be allowed.

It will not be permissible to transfer the thrust onto a complete length of pipeline or onto existing mains from which the pipeline is being filled.

Before pressure testing is carried out, the trench shall be sufficiently filled to ensure that the requisite anchorage is provided for each pipe, to prevent movement during the testing period.

1.3 Testing of Gravity Pipelines

Pipelines shall be tested and inspected for infiltration and exfiltration as laying proceeds, to facilitate relaying or replacement of any faulty pipes or joints as work proceeds. This initial testing should be applied before any sidefill is placed, using the air test to provide rapid checks for every three or four pipes laid, and to avoid the need to drain and dispose of test water.

Non-pressure pipelines laid in open cut shall be acceptance tested after they are jointed and before any concreting or backfilling is commenced, other than such as may be necessary for structural stability whilst under test.

For acceptance testing the pipeline shall be tested from manhole to manhole. Any short branches should be tested with the main line, but branches longer than approximately 10m should be tested separately.

The method for acceptance testing shall be:

- ◆ For pipelines up to and including 600mm in diameter, the water test shall be applied;
- ◆ For pipelines greater than 600mm, but not exceeding 900mm in diameter, the air test shall be applied;
- ◆ For pipelines greater than 900mm in diameter, a visual examination shall be applied.

1.4 Water Test for Gravity Pipelines

The test pressure shall not be less than 1.2m head of water above the pipe soffit or ground water level, whichever is the higher at the highest point, and not greater than 6m head at the lowest point of the section. Steeply graded sewers shall be tested in stages in cases where the maximum head, as stated above, would be exceeded if the section were tested in one length.

The pipeline shall be filled with water and a minimum period of 2 hours shall be allowed for absorption, after which water shall be added from a measuring vessel at intervals of 5 minutes and the quantity required to maintain the original water level noted. Unless otherwise specified, the length of sewer shall be accepted if the quantity of water added over a 30-minute period is less than 0.5 litres per linear metre per metre of nominal diameter.

1.5 Air Test for Gravity Pipelines

Pipelines to be air tested shall have air pumped in by suitable means until a pressure of 100mm head of water is indicated in a U-tube connected to the system. The pipeline shall be accepted if the air pressure remains above 75mm head of water after a period of 5 minutes without further pumping, following a period for stabilisation. Failure to pass the test shall not preclude acceptance of the pipeline if a successful water test is subsequently carried out.

1.6 CCTV Inspection of Pipelines

Where internal inspection of pipelines by CCTV is required, the Developer shall provide all necessary equipment, including suitable covered accommodation for viewing the monitor screen, together with personnel experienced in the operation of the equipment and interpretation of results.

The intensity of illumination within the pipe and the rate of draw of the camera shall be such as to allow a proper examination of the inside of the pipe. Provision shall be made for the movement of the camera to be stopped and its position recorded, and for permanent photographs to be taken at any point as requested by the drainage inspector.

The Developer shall be responsible for initial signing-off of CCTV results.

1.7 Infiltration and Exfiltration

Infiltration causes an increase in the legitimate flows in the sewerage system, due to groundwater entering through defects in the pipework, manholes and chambers. Exfiltration causes reduced flows in the foul system, due to leaks and outflows from faults and openings in the fabric of the system. Exfiltration of foul flows results in contamination of the surrounding soils and possible pollution of groundwater. Infiltration and exfiltration often occur together, resulting in erosion of the surrounding soils, and possible collapse.

Non-pressure pipelines and manholes shall be inspected and tested for infiltration and exfiltration, after backfilling. All inlets to the system shall be closed, and any residual flow shall be deemed to be infiltration.

The pipeline and manholes shall be accepted as satisfactory if the infiltration, including infiltration near manholes, in 30 minutes does not exceed 0.5 litres per linear meter per metre of nominal diameter.

Notwithstanding the satisfactory completion of the above inspection or test, if there is any discernible flow of water entering the pipelines or manholes which can be seen either by visual or CCTV inspection, the developer shall take such measures as are necessary to stop such infiltration. The presence of infiltration and/or exfiltration will result in refusal of taking-in-charge.

1.8 Watertightness of Manholes

All such structures shall be inspected to ensure that they are watertight, with no identifiable flow of water penetrating the chamber.

1.9 Watertightness of Chambers, Sumps and Wet Wells

As well as inspection for watertightness, all structures intended to retain water for long periods, such as sumps, interceptors and tanks, shall be water tested to confirm no measurable loss of water and external sign of leakage.

1.10 Testing of Pressure Pipelines (excluding Thermoplastic Pressure Pipes)

The entire pipeline shall be pressure tested.

Pumping mains shall be tested by the developer after that are jointed and before any concreting or backfilling is commenced, other than such as may be necessary for structural stability under test.

Gauges used for testing pumping mains shall be either of the conventional circular type, not less than 200mm diameter, calibrated in metres head of water, or shall have a digital indicator capable of reading increments of 0.1m head. Before any gauge is used, the developer shall arrange for it to be checked independently, and a dated certificate of accuracy shall be provided.

Before testing, valves shall be checked and sealed, the sections of main filled with water and the air released.

The pressure in the pumping main shall then be raised steadily until the specified test pressure is reached in the lowest part of the section, and the pressure shall be maintained at this level, by pumping if necessary, for a period of at least 1 hour. The pump shall then be disconnected, and no further water shall be permitted to enter the pumping main for a further period of 1 hour. At the end of this period, the original pressure shall be restored by pumping, and the loss measured by drawing off water from the pumping main until the pressure as at the end of the test is again reached.

The permissible loss shall not exceed 2 litres per metre nominal diameter per kilometre length per meter head (calculated as the average head applied to the section) per 24 hours.

The developer shall provide, and subsequently dispose of the water required for the test. Discharges to sewers shall not take place without the consent of the drainage inspector.

Test pressures for pumping mains shall be 1.5 times the maximum operating pressure at the lowest point of the main, or the maximum operating pressure plus the maximum surge pressure, ever is the greater.

1.11 Testing of Thermoplastic Pressure Pipelines

The Clauses for Testing of Pressure Pipelines (excluding Thermoplastic Pressure Pipes) shall apply, except that testing shall be carried out in accordance with the procedures in "A guide to testing of water supply pipelines and sewer rising mains" published by WRc.

1.12 Records of Inspection and Testing

The records of all inspections and tests shall be recorded in the Regional Drainage GIS. Responsibility for entering and maintaining such records rests with the Drainage Department.

2 CONNECTIONS TO EXISTING DRAINAGE SYSTEMS

Pipe saddles for concrete or clay pipelines shall be bedded in mortar, and a mortar fillet formed to give a cover of at least 50mm to the base of the saddle. Pipe saddles for PVC-u pipelines shall be purpose made from PVC-u and shall be either a mechanical clip-on type or shall be fixed with appropriate solvent cement.

Where an appropriate saddle or junction unit is unobtainable a connection to the existing drainage may be made with a pipe of similar material, cut to give an oblique junction, so that the discharge is in the direction of flow in the main sewer. The connecting pipes shall be of such a length that the socket of the cut pipe rests on the outside barrel of the sewer, with no projection inside the main sewer. The pipe joint shall then be pointed in mortar externally and internally where practicable. Alternatively purpose made junctions may be used by cutting out sections of pipe, fitting a junction and securing with repair couplings.

Where junction pipes for future connections are required, they shall be inserted as necessary during construction of the sewers, and the ends of connections and pipes not needed for immediate use shall be effectively sealed. The position of all joints shall be recorded by the developer by measurement from the centre of the manhole cover immediately downstream, and marked on the as built record drawings.

3 STANDARDS OF CONSTRUCTION AND WORKMANSHIP

3.1 Pipelines

3.1.1 General Construction

Where socketed pipes are required to be laid on a granular or sand bed, or directly on a trench bottom, joint holes shall be formed in the bedding material or formation to ensure that each pipe is uniformly supported throughout the length of its barrel and to enable the joint to be made.

Pipes shall be laid on setting blocks only where a concrete bed or cradle is used.

Where pipes are required to be bedded directly on the trench bottom, the formation shall be trimmed and levelled to provide even bedding of the pipeline and shall be free from all extraneous matter that may damage the pipe, pipe coating or sleeving.

Pipes and fittings shall be examined for damage and the joint surfaces and components shall be cleaned immediately before laying.

Suitable measures shall be taken to prevent soil or other material from entering pipes, and to anchor each pipe to prevent flotation or other movement before the Works are complete.

Where pipeline marker tapes are specified, they shall be laid between 100mm and 300mm above the pipe. Where a tracer system is specified, it shall be continuous and adequately secured to valves and fittings.

Construction shall be carried out in general accordance with IS EN 752 Drain and sewer systems outside buildings.

3.1.2 Pipe Bedding

Bedding for pipes shall be constructed by spreading and compacting granular bedding material over the full width of the pipe trench. After the pipes have been laid, additional granular material shall, if required, be placed and compacted equally on each side of the pipes, and where practicable, this shall be done in sequence with the removal of the trench supports.

Where support from the side of the trench cannot be guaranteed, such as in old town and city streets, a bed and surround of concrete shall be provided.

Control of flow of groundwater is the developer's responsibility. Where, in the opinion of the drainage inspector, the flow of groundwater is likely to transport fine soil particles, water stops of puddles clay or 20N/mm² strength concrete, extending up through the bedding and sidefill shall be placed across the trench at each manhole, and immediately downstream of any temporary works. These water stops shall be positioned to prevent the development of a linear sub-surface watercourse parallel and outside the pipeline.

3.1.3 Concrete Protection to Pipes

Pipes to be bedded on or cradled with concrete shall be supported on precast concrete setting blocks, the top face of each block being covered with 2 layers of compressible packing.

Concrete provided as a protection to pipes shall be 20 N/mm² strength, and placed to the required depth in one operation. Where pipes with flexible joints are used, concrete protection shall be interrupted over its full cross-section at each pipe joint by shaped compressible filler.

Where pipes are protected by a concrete cover slab placed above the pipe, this shall extend across the full width of the trench and there shall be a minimum of 150 mm of surround between the crown of the pipe and underside of the slab.

3.1.4 Completion of Pipe Surround

After completion of the relevant operations above, fill material shall, where required, be placed and compacted over the full width of the trench in layers not exceeding 150 mm before compaction, to be finished thickness of 250 mm above the crown of the pipes.

Subsequent backfilling shall then be carried out as specified elsewhere.

3.1.5 Pipe Jointing Generally

Pipe jointing surfaces and components shall be kept clean and free from extraneous matter until the joints have been made or assembled. Care should be taken to ensure that there is no ingress of grout or other extraneous material into the joint annulus after the joint has been made.

Laying and jointing of pipelines is the developer's responsibility. Where, with the agreement of the drainage inspector, pumping mains are laid to curves, the deflection at any pipe joint as laid shall not exceed three-quarters of the maximum deflection recommended by the manufacturer.

Site fusion jointing in polyethylene pipelines shall be undertaken in accordance with the relevant provisions of WIS 4-32-08.

3.1.6 Cutting Pipes

Pipes shall be cut in accordance with the manufacturer's recommendations. Where necessary, the cut ends of pipes shall be formed to the tapers and chamfers suitable for the type of joint to be used.

Where ductile iron pipes are to be cut to form non-standard lengths, the Developer shall comply with the manufacturer's recommendations in respect of ovality correction and tolerances to the cut spigot end.

Where concrete pipes are cut, any exposed reinforcement shall be sealed with an epoxy resin mortar.

3.1.7 Thrust Blocks

Except where self-anchoring joints are used, thrusts from bends and branches in pumping mains shall be resisted by Grade C20 concrete thrust blocks cast in contact with undisturbed ground.

Any additional excavation required to accommodate thrust blocks shall be carried out after the bend or branch is in position, and the thrust face shall be trimmed back to remove all loose or weathered material immediately prior to concreting.

Thrust blocks shall be allowed develop adequate strength before any internal pressure is applied to the pumping main.

Rapid hardening cement shall not be used in concrete for the protection of plastic pipes.

Plastic pipes shall be wrapped with 3 layers of plastic sheeting being surrounded by concrete.

3.1.8 Tolerances in Gravity Sewers and Pumping Mains

The position of the internal face of any sewer and pumping main shall not deviate from the line and level described in the drawings or agreed variation by more than 20 mm, provided that no sewer shall have a reverse gradient.

3.2 Manholes, Chambers (including Non-Man Access Chambers) and Wet Wells

3.2.1 Brickwork and Blockwork

Brickwork and blockwork construction shall be in accordance with the relevant provisions of BS 5628: Part 3. Within Dublin City Council boundaries, high-density blocks, faced with engineering bricks shall be used for all construction work on foul and combined sewers.

Brickwork and blockwork shall be built in English bond. Bricks and blocks shall be set in mortar with all bed and vertical joints filled solid; exposed work shall be flush pointed as the work proceeds. The moisture content of the bricks and blocks shall be adjusted so that excessive suction is not exerted on the mortar.

Bricks and blocks in each course shall break joint correctly with the bricks/blocks underneath. The courses shall be laid parallel, with joints of uniform thickness, and shall be kept straight or regularly curved as required. Brickwork and blockwork shall be gauged to rise 300mm in 4 courses. Vertical joints shall be in alignment as required by the bond and shall have an average thickness of 10mm. Bricks and blocks forming reveals and internal and external angles shall be selected for squareness and built plumb.

Brickwork and blockwork shall rise uniformly; corners and other advanced work shall be racked back and not raised above the general level more than 1 m. No brickwork or blockwork shall be carried up higher than 1.5 m in 1 day. No bats or broken bricks or blocks shall be incorporated in the work unless essential for bond.

Further requirements are contained in Appendix G Standard Drawing Format and Details.

3.2.2 Corbelling

Oversail corbelling shall not exceed 30 mm on each course.

3.2.3 Bricklaying and Blocklaying in Cold Weather

Materials used in bricklaying and blocklaying shall be frost-free, and no bricks or blocks shall be laid when the ambient temperature is below 3°C, unless special precautions are taken. Completed work shall be protected adequately during cold weather.

3.2.4 Precast Concrete Manholes, Chambers and Wet Well

Precast concrete manhole sections for manholes shall be constructed with steps, ladders and slabs aligned correctly.

The jointing material for precast units shall be mortar or a proprietary bitumen or resin mastic sealant, with the concrete surfaces prepared in accordance with the manufacturer's recommendations.

Joints shall be made so that the required jointing material fills the joint cavity. Any surplus jointing material that is extruded inside the manhole, chamber, or wet well shall be trimmed off and joints shall be pointed on completion.

Concrete surrounds to manholes, chambers and the wet well shall be Grade C20 and the height of each concrete pour shall not exceed 2 m. Each construction joint shall break joint with the precast sections by at least 150 mm.

3.2.5 In-Situ Inverts and Benching

Inverts and benching in manholes, chambers and the wet well shall have a screeded ridged finish and shall have a smooth, high strength concrete topping applied with a steel trowel before the concrete has set.

3.2.6 Pipes and Joints Adjacent to Structures

A flexible joint shall be provided as close as is feasible to the outside face of any structure into which a pipe is built. The design of the joints shall be compatible with any subsequent movement.

The recommended length of the next pipe (rocker pipe) away from the structure should be as shown in the table below:

Nominal Diameter (mm)	Effective Length (m)
150 to 600	0.6
675 to 750	1.0
over 750	1.25

Stub pipes into structures shall be of rigid material.

3.2.7 Setting Manhole Covers and Frames

Manhole frames shall be set to level, bedded and haunched externally over the base and sides of the frame in mortar in accordance with the manufacturer's instructions. The frame shall be seated on at least 2 courses of Class B engineering bricks, or on precast concrete masonry units or on precast concrete cover frame seating rings to regulate the distance between the top of the cover and the top rung to no greater than 450 mm below surface level. Within Dublin City Council boundaries, the final lift from cover slab to manhole cover shall be constructed in concrete.

A mortar fillet shall be provided where the corners to an opening in a slab are chamfered and the brickwork is not flush with the edges of the opening.

The positioning of the opening shall be such that the rungs do not protrude vertically below the opening, and the first rung shall be less than 450mm below surface level.

3.2.8 Non-Man Access Chambers

Non-man chambers shall comply with relevant provision of BS EN 752-3.