6 SURFACE WATER DRAINAGE

6.1 GENERAL

6.1.1 Scope

1 This Part specifies the requirement for pipework, gullies, manholes, catch pits, soakaways and other items related to surface water drainage.

2 Related Sections and Parts are as follows:

This Section

Part 1 ..... General
Part 6..... Commissioning of Systems

Section 5 Concrete

6.1.2 References

The following standards are referred to in this Part:

BS 65.....Vitrified clay pipes, fittings and ducts, also flexible mechanical joints for use solely with surface water pipes and fittings

BS 497.....Manhole covers, road gully grating and frames for drainage purposes.

BS 743.....Materials for damp-proof courses

BS 1142.....Fibre building boards

BS 1247.....Manhole steps

BS 2494.....Elastomeric seals for joints in pipework and pipelines

BS 5911.....Precast concrete pipes, fittings and ancillary products

BS 6076.....Tubular polythene film for use as protective sleeving for buried iron pipes and fittings

EN 124 .....Gully tops and manhole tops for vehicular and pedestrian areas

EN 295 .....Vitrified clay pipes and fittings and pipe joints for drains and sewers.

EN 1401 .....unplasticized polyvinyl chloride (PVC-U) pipes and plastic fittings of nominal sizes 110 and 160 for below ground gravity drainage and sewerage

EN 1401 .....unplasticized PVC pipe and fittings for gravity sewers

EN 13476 .....Multilayer unplasticized polyvinyl chloride (PVC-U) pipes and plastic fittings of nominal sizes 110 and 400 for below ground drainage and sewage and gravity sewers

6.1.3 Submittals

1 The Contractor shall order materials to suit the construction programme and obtain the Engineer's approval of submittals before placing orders. The Contractor shall submit two copies of the following documents for the approval of the Engineer.

(a) Product Data

(i) originals of catalogues and engineering data sheets for manufactured items; each item and option to be provided shall be clearly marked and each item not to be provided shall be deleted

(ii) literature to show that products provided meet the requirements for material, construction, operation, and testing

(iii) information on the following items as a minimum: pipes; pipe jointing systems, manhole covers and frames and gully covers, gratings and frames.

(iv) manufacturer's installation instructions for all items

(v) certified reports for all tests and inspections designated herein, signed and sealed, showing full compliance with referenced standards

(vi) maintenance requirements and procedures

(vii) period of guarantee for products.

(b) Shop Drawings showing the following:

(i) profiles of each pipe system including chainage, ground levels, invert levels, critical clearances and position of pipework structures.

(ii) material, class, grade, joint type, pressure rating, dimension, location and identification number of each pipe and pipe fitting to be furnished and installed.

(iii) procedures for building pipes into concrete structures.

(iv) procedures for encasing pipes in concrete.

(v) class, dimensions, location and identification of each manhole cover and frame to be furnished and installed.

(vi) procedures for placing and fixing manhole covers and frames.

(vii) class, dimensions, location and identification of each gully cover, grating and frame to be furnished and installed.

(viii) procedures for placing and fixing gully covers, gratings and frames.

(ix) details for handling and storage of pipes, manhole covers and frames and gully covers, gratings and frames.

(x) all other miscellaneous details required for complete installation.

6.1.4 Pipe Marking

1 Each pipe and pipe fitting shall be marked with the following:

(a) serial number

(b) class of pipe

(c) nominal diameter

(d) name or trademark for manufacturer

(e) date of manufacture.

6.1.5 Handling and Storage

1 Each item to be provided under this Part shall be stored and handled in accordance with the recommendations of the manufacturer of the item.

2 Products susceptible to ultra violet degradation shall be stored under cover and out of direct sunlight.

3 Pipes and fittings shall be subject to visual inspections after off-loading at the site and before installation.

6.1.6 Quality Assurance

1 Pipes, pipe fittings, manhole covers and frames and gully covers, gratings and frames shall be supplied by approved manufacturers as designated in the Project Specification. Production facilities shall be quality assessed in accordance with ISO 9000 or equivalent.

6.2 PIPEWORK

6.2.1 General

1 Pipes shall have adequate strength to meet the loading requirements, be sufficiently robust to withstand site handling and be sufficiently durable to remain watertight for the anticipated life of the system. Pipes and joints should remain sufficiently water tight to prevent the ingress of ground water.

6.2.2 Vitrified Clay Pipework

1 Vitrified clay pipes and fittings for surface water drainage shall comply with the relevant provisions of EN 295.

2 Pipes and pipe fittings shall be extra strength class.

3 All pipes and pipe fittings shall have flexible mechanical joints. Pipes with diameters larger than 150 mm shall have spigot and socket joints complying with the relevant provisions of EN 295. Spigot and socket joints shall have elastomeric joint seals, Type D, complying with the relevant provisions of BS 2494, and shall be obtained from the pipe manufacturer. Push-fit (sleeve type) polypropylene flexible couplings may be used in place of spigot and socket joints for pipes up to 150 mm diameter.

6.2.3 Unplasticized Polyvinyl Chloride (PVC-U) Pipework

1 PVC-U pipes and fittings for surface water drainage shall comply with the relevant provisions of EN 1401 or EN 13476.

2 All pipes and pipe fittings shall have spigot and socket joints complying with the relevant provisions of EN 13476. Spigot and socket joints shall incorporate Type D elastomeric joint seals complying with the relevant provisions for BS 2494 and shall be obtained from the pipe manufacturer.

6.2.4 Reinforced Concrete Pipes

1 Reinforced concrete pipes and fittings and flexible or ogee joints shall comply with the relevant provisions of BS 5911: Parts 100 and 110 respectively.

2 All pipes and fittings shall have gasket type joints of spigot and socket or rebated form, unless otherwise described in the Project Specification or shown on the Project Drawings.

6.2.5 Testing of Pipework

1 Pressure tests shall be carried out on surface water drainage pipes. Test procedures are detailed in Part 6 of this Section.

6.3 PIPE LAYING

6.3.1 General

1 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 final excavated surface to ensure that each pipe is uniformly supported throughout the length of its barrel and to enable the joint to made.

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

3 Where pipes are required to be bedded directly on the trench bottom, the final excavated surface 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.

4 No protective cap, disc or other appliance on the end of a pipe or fitting shall be removed permanently until the pipe or fitting which it protects is about to be jointed. Pipes and fittings, including any lining or sheathing, shall be examined for damage and the joint surfaces and components shall be cleaned immediately before laying.

5 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.

6 Where pipeline marker tape is specified, it shall be laid between 100 mm and 300 mm above the pipe.

Pipe Bedding

1 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 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.

6.3.2 Concrete Protection to Pipes

1 Pipes to be bedded on or cradled with concrete shall be supported on precast concrete setting blocks. The top face of each block shall be covered with two layers of compressible packing complying with BS 743.

2 Concrete provided as a protection to pipes shall be Grade C20, placed to the required depth in one operation.

3 Where pipes with flexible joints are used, concrete protection shall be interrupted over its full cross-section at each pipe joint by a shaped compressible filler of bitumen impregnated insulating board to BS 1142 or equally compressible material. The thickness of the compressible filler shall be in accordance with Table 6.1.

Table 6.1
Thickness of Compressible Filler

Nominal bore of pipe (mm)	Thickness of compressible filler (mm)
Less than 450	18
450 to 1200	36
Exceeding 1200	54

4 Rapid hardening cement shall not be used in concrete for the protection of plastics pipe.

5 Plastics pipes shall be wrapped with a layer of plastic sheeting complying with a composition in accordance with Clause 3 of BS 6076 and a nominal thickness of 125 microns before being surrounded by concrete.

6.3.3 Completion of Pipe Surround

1 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 a finished thickness of 250 mm above the crown of the pipes.

6.3.4 Backfilling

1 Backfilling shall, wherever practicable, be undertaken immediately the specified operations preceding it have been completed. Backfilling shall not, however, be commenced until the works to be covered have achieved a strength sufficient to withstand all loading imposed thereon.

2 Backfilling around existing structures shall be undertaken in such manner as to avoid uneven loading or damage.

3 Filling material to excavations shall be deposited in layers not exceeding 250mm unconsolidated thickness and compacted to 95% modified proctor.

4 Where the excavations have been supported and the supports are to be removed, these, where practicable, shall be withdrawn progressively as backfilling proceeds in such a manner as to minimise the danger of collapse. All voids formed behind the supports shall be carefully filled and compacted

6.4 GULLIES AND DRAINAGE CHANNELS

6.4.1 Gullies

1 Gullies shall incorporate rodding eyes. Rodding eyes shall be fitted with rubber stoppers during normal operation.

2 All gullies shall be trapped to prevent unwanted odours escaping from the drain.

3 All gullies shall incorporate aluminium silt buckets.

4 The Contractor shall ensure that the gully outlet and the outlet pipework are compatible.

5 Gully covers, gratings and frames shall comply with the relevant provisions of BS 497: Part 1 or EN 124.

6 The class of gullies covers, gratings and frames shall be as described in the Project Specification or as shown on the Project Drawings.

6.4.2 Pre-formed Gullies

1 Precast concrete gullies shall comply with the relevant provisions of BS 5911: Part 2 and Section 5 - Concrete.

2 Vitrified clay gullies shall comply with the relevant provisions at EN 295: Part 1 or BS 65.

3 Polypropylene gullies shall be of a type detailed in the Project Specification or shown on the Project Drawings and shall be obtained from a reputable manufacturer as approved by the Engineer.

4 Cast iron gullies shall be of a type detailed in the Project Specification or shown on the Project Drawings and shall be obtained from a reputable manufacturer as approved by the Engineer.

5 Pre-formed gullies shall be bedded and surrounded with Grade C20 concrete to the thickness described in the Contract Documentation.

6 Frames shall be bedded in mortar on two courses of Class B engineering brickwork or precast concrete gully cover slabs. Precast concrete gully cover slabs shall comply with the relevant provisions of BS 5911: Part 2 and Section.

6.4.3 Drainage Channels

1 Precast concrete drainage channels shall comply with the relevant provisions of BS 5911: Part 2 and Section 5 - Concrete.

2 Drainage channel gratings and frames shall comply with the relevant provisions of EN 124.

6.5 SOAKAWAYS

6.5.1 General Requirements

1 Soakaways shall not be constructed closer than 10 m from a building or in a position where the ground below foundations is likely to be adversely affected.

2 Excavation round the soakaway shall be backfilled with a band of 40mm nominal single size stone to provide a permeable surround to the soakaway. The permeable surround shall be fully wrapped in a geotextile fabric. The dimensions of the band shall be as shown on the Project Drawings.

6.6 MANHOLES AND CATCH PITS

6.6.1 General Requirements

1 Bases and walls to manholes and catch pits shall be cast in situ using Grade C30 concrete.

2 Cover slabs to manholes shall be precast using Grade C40 concrete and shall incorporate an integral GRP liner with a minimum thickness of 3.5 mm. The vertical sides of the openings of cover slabs shall be formed of filament would GRP pipe and soffits shall be formed of GRP sheet.

3 The Contractor shall provide the Engineer with a seven year unconditional guarantee against failure of all GRP linings whether caused by defective materials or workmanship. The guarantee shall be valid from the date of completion of the installation and must be handed over to the Engineer before the issue of the Final Completion Certificate.

4 Unless otherwise stated in the Project Specification or shown on the Project Drawings, manhole inverts and benching shall be formed in Grade C20 concrete. Where there is no change of diameter, the invert of the benching shall follow the same gradient as the outgoing pipe.

5 Where a high strength concrete topping (granolithic finish) is required, the invert and benching shall be formed in Grade C20 concrete, and the topping shall be applied as soon as practicable thereafter.

6 All concrete works, including benching, shall comply with the relevant provisions of Section 5 - Concrete.

7 Step irons shall comply with the relevant provisions of BS 1247:Parts 1, 2 and 3.

8 Covers and frames shall comply with the relevant provisions of BS 497:Part 1 and have a minimum clear opening of 600 mm diameter if circular or 600 x 750 mm if rectangular. All covers shall have closed keyways.

9 The Contractor shall prepare a standard record sheet for every manhole and catch pit to the approval of the Engineer.

10 Testing of manholes and catch pit chambers shall be as detailed in Part 6 of this Section.

6.7 CONNECTION TO GOVERNMENT MAIN

6.7.1 General Requirements

1 Connection to government mains shall be done at manholes. Pipe saddles and oblique junctions will not be permitted.

2 Where possible and practicable, connections shall be made to future connection ports in existing Government manholes. The caps on future connection ports to which connections are made shall be cleaned and delivered to the government stores on completion of the work.

3 Where it is not possible or practicable to utilise future connection ports in existing manholes, connections shall be made by either breaking into existing manholes or constructing new manholes on existing mains.

4 If it is necessary to break into an existing manhole, the Contractor shall break into the manhole wall, insert pipework, break out the existing benching, construct benching to suit new connection and make good. If necessary, the Contractor shall relocate the access ladder and the cover slab to suit the new benching layout.

5 Manholes built on an existing Government mains shall be constructed in accordance with Clause 6 of this Part. On completion, such manholes shall become the property of the government.

6 The Contractor shall be responsible for all over-pumping operations associated with making connections to Government mains:

7 When a connection is made to an existing manhole in an area with high groundwater levels, the Contractor shall undertake the following if instructed to by the Engineer.

(a) undertake a CCTV survey and deflection test between the manhole immediately upstream and the manhole immediately downstream of the manhole to which the connection is to be made before commencing dewatering operations.

(b) construct two mass concrete stanks round the base of the manhole to prevent groundwater from flowing into the excavation. The stanks shall be positioned each side of the proposed connection and shall extend across the full width of the excavation. The stanks shall be in place before any dewatering takes place.

(c) undertake a CCTV survey and deflection test between the manhole immediately upstream and the manhole downstream of the manhole to which the connection has been made when work is complete and groundwater levels have returned to their natural levels.

(d) the Contractor shall submit all CCTV survey data and deflection test data to the Engineer. Such data shall be used to determine whether any damage has been caused to the existing main by the Contractor while carrying out his work.

(e) the Contractor shall be responsible for rectifying any damage caused as a result of his work.

(f) the Contractor shall submit his proposals for carrying out remedial works to the Engineer for approval prior to starting such work, should it be necessary.

END OF PART