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3 PLUMBING PIPEWORK IN TRENCHES

3.1 GENERAL

3.1.1 Scope

- 1 This Part specifies the requirements for pipes and fittings for below ground plumbing works.
- 2 Related Sections and Parts are as follows:

This Section

Part 1..... General

Part 2..... Water Distribution

Part 6..... Commissioning of Systems

Section 1 General

Section 5 Concrete

3.1.2 References

- 1 The following standards are referred to in this Part:

BS 743.....Specification for materials for damp-proof courses

BS 864Capillary and compression tube fittings of copper and copper alloy; (BS 864-2 Capillary and compression tube fittings of copper and copper alloy - Specification for capillary and compression fittings for copper tubes; EN 1254-1 Copper and copper alloys. Plumbing fittings - Capillary fittings for soldering or brazing to copper tubes; EN 1254-2 Copper and copper alloys. Plumbing fittings - Compression fittings for use with copper tubes; BS 864-3 Capillary and compression tube fittings of copper and copper alloy - Compression fittings for polyethylene pipes; BS 864-5 Capillary and compression tube fittings of copper and copper alloy - Specification for compression fittings for polyethylene pipes with outside diameters to BS 5556; EN 1254-3 Copper and copper alloys. Plumbing fittings - Compression fittings for use with plastics and multilayer pipes).

BS 882.....Specification for aggregates from natural sources for concrete; (EN 12620 Aggregates for concrete; BSI PD 6682-1 Aggregates - Aggregates for concrete. Guidance on the use of BS EN 12620; EN 13139 Aggregates for mortar; EN 13242 Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction; BSI PD 6682-6 Aggregates - Aggregates for unbound and hydraulically bound materials for use in civil engineering works and road construction. Guidance on the use of BS EN 13242; EN 13055 Lightweight aggregates; BSI PD 6682-4 Aggregates - Lightweight aggregates for concrete, mortar and grout. Guidance on the use of BS EN 13055-1)

- BS 1142.....Specification for fibre building boards; (EN 622-1 Fibreboards - Specifications - Part 1: General requirements; EN 622-2 Fibreboards - Specifications - Part 2: Requirements for hardboards; EN 622-3 Fibreboards - Specifications - Part 3: Requirements for medium boards; EN 622-4 Fibreboards - Specifications - Part 4: Requirements for softboards; EN 622-5 Fibreboards - Specifications - Part 5: Requirements for dry process boards (MDF); EN 310 Wood-based panels - Determination of modulus of elasticity in bending and of bending strength; EN 316 Wood fibre boards - Definition, classification and symbols; EN 317 Particleboards and fibreboards - Determination of swelling in thickness after immersion in water; EN 318 Wood based panels - Determination of dimensional changes associated with changes in relative humidity; EN 320 Particleboards and fibreboards - Determination of resistance to axial withdrawal of screws; EN 321 Wood-based panels - Determination of moisture resistance under cyclic test conditions; EN 322 Wood-based panels - Determination of moisture content; EN 323 Wood-based panels - Determination of density; EN 324-2 Wood-based panels - Determination of dimensions of boards - Part 2: Determination of squareness and edge straightness; EN 325 Wood-based panels - Determination of dimensions of test pieces; EN 382-1 Fibreboards - Determination of surface absorption - Part 1: Test method for dry process fibreboards; ISO 12460-5 Wood-based panels — Determination of formaldehyde release — Part 5: Extraction method (called the perforator method)
- BS 2494.....Specification for elastomeric seals for joints in pipework and pipelines.
- BS 2871.....Specification for copper and copper alloys; (BS 2871-1 Specification for copper and copper alloys. Tubes - Copper tubes for water, gas and sanitation; EN 1057 Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications; BS 2871-2 Specification for copper and copper alloys. Tubes - Tubes for general purposes; EN 12449 Copper and copper alloys. Seamless, round tubes for general purposes; BS 2871-3 Specification for copper and copper alloys. Tubes - Tubes for heat exchangers; EN 12451 Copper and copper alloys. Seamless, round tubes for heat exchangers).
- BS 3505.....Specification for unplasticized polyvinyl chloride (PVC-U) pressure pipes for cold potable water; (ISO 1452-1 Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: General; ISO 1452-2 Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 2: Pipes; ISO 1452-3 Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 3: Fittings; ISO 1452-4 Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 4: Valves; ISO 1452-5 Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 5: Fitness for purpose of the system).

- BS 4127.....Specification for light gauge stainless steel tubes, primarily for water applications; (EN 10312 Welded stainless steel tubes for the conveyance of aqueous liquids including water for human consumption. Technical delivery conditions).
- BS 4346.....Joints and fittings for use with unplasticized PVC pressure pipes.
- BS 4772.....Specification for ductile iron pipes and fittings; (EN 545 Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods; EN 598 Ductile iron pipes, fittings, accessories and their joints for sewerage applications. Requirements and test methods; EN 969 Ductile iron pipes, fittings, accessories and their joints for gas pipelines. Requirements and test methods).
- BS 4991.....Specification for propylene copolymer pressure pipe.
- BS 5114.....Specification for performance requirements for joints and compression fittings for use with polyethylene pipes.
- BS 6076.....Specification for polymeric film for use as a protective sleeving for buried iron pipes and fittings (for site and factory application).
- BS 6572.....Specification for blue polyethylene pipes up to nominal size 63 for below ground use for potable water; (EN 12201-1 Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE) – General; EN 12201-2 Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE) – Pipes; EN 12201-5 Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE) - Fitness for purpose of the system).
- BS 6700.....Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages Specification; (BS 8558 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complementary guidance to BS EN 806; EN 806-1 Specifications for installations inside buildings conveying water for human consumption – General; EN 806-2 Specifications for installations inside buildings conveying water for human consumption – Design; EN 806-3 Specifications for installations inside buildings conveying water for human consumption - Pipe sizing. Simplified method; EN 806-4 Specifications for installations inside buildings conveying water for human consumption – Installation; EN 806-5 Specifications for installations inside buildings conveying water for human consumption - Operation and maintenance).
- EN 545Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods.
- EN 1254-3Copper and copper alloys. Plumbing fittings - Compression fittings for use with plastics and multilayer pipes
- EN 10312Welded stainless steel tubes for the conveyance of aqueous liquids including water for human consumption. Technical delivery conditions
- ISO 1452Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U).
- ISO 2531Ductile iron pipes, fittings, accessories and their joints for water applications

- ISO 4179Ductile iron pipes and fittings for pressure and non-pressure pipelines — Cement mortar lining
- ISO 4427Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE).
- ISO 8179Ductile iron pipes, fittings, accessories and their joints — External zinc-based coating.

3.2 PIPES AND FITTINGS

3.2.1 General Requirements

- 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.
- 2 Every pipe, pipe joint and connected fitting shall be capable of withstanding, without damage or deterioration, sustained temperatures of up to 65°C when operating under normal working pressures.
- 3 Pipe materials, fittings, linings and jointing materials shall impart no taste, colour, odour or toxicity to the water nor promote or foster the microbial growth under the conditions where they are going to be installed.
- 4 If pipes, pipe joints or fittings are of dissimilar metals, measures shall be taken to prevent corrosion. Contact between pipework components of dissimilar metals shall be avoided in below ground installations.

3.2.2 Pipe Materials

- 1 Copper pipework shall comply with the relevant provisions of BS 2871: Part 1, Table Y, coated with seamless continuous PVC sheeting. Copper and copper alloy tube fittings should comply with the relevant provisions of BS 864: Part 2.
- 2 The use and installation of polyethylene pipework shall comply with the relevant provisions of ISO 4427. Copper alloy tube fittings for polyethylene pipes shall comply with the relevant provisions of EN 1254: part 3, Joints for polyethylene pipes shall comply with the relevant provisions of BS 5114 and BS 3505.
- 3 The use and installation of polypropylene pipework shall be in accordance with the relevant provisions of BS 4991 and shall be Series 1.
- 4 The use and installation of unplasticized PVC pipework shall comply with the relevant provisions of BS 3505. Solvent welded joints and fittings for PVC-U pipes shall comply with the relevant provisions of ISO 1452. Mechanical joints and fittings for PVC-U pipes shall comply with the relevant provisions of ISO 1452.
- 5 Ductile iron pipework shall comply with the relevant provisions of EN 545:2006, ISO 2531, ISO 4179 and ISO 8179.
- 6 Stainless steel pipework shall comply with the relevant provisions of EN 10312 grade SS 316L.

3.3 PIPEWORK JOINTING

3.3.1 General Requirements

- 1 Jointing of pipes shall be in accordance with the relevant provisions of BS 6700.

- 2 All proprietary joints shall be made in accordance with the manufacturer's instructions.
- 3 Care shall be taken to establish satisfactory jointing techniques for all water service pipework. All burrs shall be removed from the ends of the pipes and any jointing materials used shall be prevented from entering the water system
- 4 All piping and fittings shall be cleaned internally and be free from particles of sand, soil metal filings and chips etc.
- 5 Jointing systems using elastomeric sealing rings shall be Type W, complying with the relevant provisions of BS 2494, and shall be obtained from the pipe manufacturer.

3.4 PIPE LAYING

3.4.1 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. Where rock is encountered, the trench shall be cut at least 150 mm deeper than other ground and made up with well compacted selected fill material.
- 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.

3.4.2 Bedding

- 1 Bedding for pipes shall be constructed by spreading and compacting granular bedding material over the whole 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 pipe, and where practicable, this shall be done in sequence with the removal of the trench supports.

- 2 Unless otherwise detailed in the Project Documentation, bedding material shall be in accordance with Table 3.1

Table 3.1
Bedding Material

Pipe Diameter	Bedding
up to 65 mm	Sand
65 - 100 mm	10 mm single sized aggregate
100 - 200 mm	10 or 14 mm single sized or 14-15 mm graded aggregate
Over 200 mm	10, 14 or 20 mm single sized or 15-5 or 20-5 mm graded aggregate.

- 3 Nominal single sized aggregate and graded aggregate shall comply with Table No. 4 of BS 882.
- 4 Sand for bedding material shall comply with the relevant provisions of BS 882.
- 5 Bedding systems other than those specified above may be allowed upon approval of the Engineer or as recommended by the pipe manufacturer.

3.4.3 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 3.2.

Table 3.2
Thickness of Compressible Filler

Nominal bore of pipe (mm)	Thickness of compressible filler (mm)
up to 300	13
Over 300 and up to 600	25
Over 600 and up to 1200	38

- 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 Concrete work shall comply with the relevant provisions of Section 5, Concrete.

3.4.4 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.

3.4.5 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 parts of 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 250 mm 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

3.4.6 Protective Coatings

- 1 Coatings, sheathings or wrappings shall be examined for damage, repaired where necessary, and made continuous before trench excavations are backfilled.

3.4.7 Pipes under Buildings

- 1 Where a pipe has less than 300 mm of cover under a load bearing slab, it should be surrounded with concrete as an integral part of the slab. Where possible, the concrete surround shall be poured at the same time as the slab. The surround shall be tied to the slab with nominal steel reinforcement placed vertically with turned over ends.
- 2 No provision for pipe flexibility along the concrete surround shall be made, unless an expansion joint is included in the slab. A construction joint should be included in the surround at that point which must also coincide with a pipe joint.
- 3 In normal, stable ground conditions, and with 300 mm or more of cover to the pipeline beneath the slab, a total granular surround can be used as a pipe bedding. Refer to Clause 3.4.2 for bedding specification.
- 4 Flexibility shall be incorporated into the pipeline as it leaves any concrete surround.
- 5 Where plastic pipes are to be surrounded in concrete, Clause 3.4.3 of this Part shall be complied with.

3.4.8 Avoidance of Contamination

- 1 No pipe shall be laid or installed near a sanitary manhole, cesspool, septic tank, soakaway, refuse pit or other feature likely to cause the water to become contaminated and/or cause deterioration to the pipe material.
- 2 Any pipe that crosses over a sewer shall be laid so that there is at least 600 mm clearance between the pipe barrels. Any pipe that lies adjacent to a sewer shall be laid so that there is at least 3m between the barrels. Plumbing pipes shall not be laid below sewers.

- 3 Where the above criteria cannot be met, and with the approval of the Engineer in writing, the pipe shall be encased in concrete. The limit of the concrete encasement shall be determined on site by the Engineer. No breaks in the concrete encasement shall be made at joints. If the concrete encasement extends over one or more joints it shall be treated as a beam and reinforced appropriately; in such cases, the Contractor shall prepare reinforcement details with supporting calculations and submit them to the Engineer for approval.
- 4 Where it is necessary to determine the extent of contamination, the Contractor shall arrange for soil samples to be taken and tested. The locations at which soil samples are taken and the number of samples to be taken shall be determined by the Engineer.

3.4.9 Restraint of Pipes

- 1 Except where the method of jointing and normal trench backfill are adequate to prevent longitudinal movement, Grade C20 concrete thrust blocks cast in contact with undisturbed ground shall be constructed at changes in direction, junctions and blank ends.
- 2 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.
- 3 Thrust blocks shall be required to develop adequate strength before any internal pressure is applied to the pipeline.
- 4 Where plastic pipes are to be surrounded in concrete, Clause 3.4.3. of this Part shall be complied with.

3.4.10 Testing of Pipework

- 1 Pressure tests shall be carried out on below ground plumbing pipes. Test procedures are detailed in Part 6 of this Section.

3.4.11 Surface Boxes

- 1 Surface boxes shall be provided to give access to operate valves.

END OF PART