SECTION 14

Sanitary Fixtures

DIVISION 15

MECHANICAL WORKS

SECTION 14

SANITARY FIXTURES

INDEX

DIVISION 15

MECHANICAL WORKS

SECTION 14

SANITARY FIXTURES

14.01 GENERAL REQUIREMENTS

The Contractor shall furnish and install all the sanitary fixtures as shown on the Drawings and as specified below, complete with all their trim and accessories as specified..

Sanitary fixtures shall be of vitreous china to BS 3402, unless otherwise specified and of color as specified. Fixtures shall have smooth glazed surface free from warp, cracks, flaws, discoloration or other imperfections. Imperfect fixtures will not be accepted.

Sanitary fixtures shall be supplied complete with all required metal trim and accessories, as specified, including but not necessarily limited to faucets, wastes, traps, supplies, stop valves, wall flanges, hangers, plates, brackets, anchors, supports, soap holders, toilet paper holders, etc.

All exposed piping and metal trim for the sanitary fixtures shall be chrome plated brass to BS 5750 Part(1) with polished finish.

All vitreous china accessories shall match the sanitary fixtures and shall be of the same manufacture and colour.

All sanitary fixtures, trim and accessories shall be the product of a reputable and approved manufacture and as far as practicable shall be procured from one manufacturer unless specified otherwise.

Sanitary fixtures and their trim and accessories shall be installed in a neat, finished and uniform manner as directed by the Engineer. They shall be set straight and true and securely attached to the supporting surfaces. Roughing shall be accurately laid out to conform to finished walls and floors.

The colour of sanitary fixtures shall be white for all fixtures unless other wise directed by the architect.

Sanitary fixtures shall be connected to the drain and water supply pipes in an approved gastight and watertight manner and as detailed on the Drawings.

Strap or padded wrenches shall be used on chrome plated pipe, fittings, valves and other trim.

Sanitary fixtures, metal trim and accessories shall be thoroughly cleaned of labels, plaster, paint droppings and all foreign matter and shall be well polished and tested for perfect working condition before turning them over to the Employer.

14.01 GENERAL REQUIREMENTS (CONT'D)

Concealed brackets, hangers and plates shall be painted as directed by the Engineer.

The Contractor shall submit to the Engineer a list of all fixtures, trim and accessories that he proposes to use indicating manufacturer, type and model number, with descriptive catalogues clearly marked as to the item proposed.

The Contractor shall submit samples of all fixtures, trim and accessories when asked to do so by the Engineer. The Contractor shall not charge the Employer with the cost of such samples nor shall he use any item different from the approved sample.

14.02 W.C. FLOOR MOUNTED

White vitreous china, complete with the following trim and accessories:

- Solid plastic seat without cover, hygienic open front design with stainless steel hinge, rubber washers and plastic screws and nuts.
- 9 liter low level cistern and valve less fitting including syphone, side inlet ball valve, internal overflow, plastic flush bend, inter connection and reversible chrome plated cistern lever and cistern support.
- Chrome plated angle valve with copper tube flexible connection and escutcheon.
- W.C. plastic outlet connector.
- W.C. bowel S-trap.
- Toilet paper holder, screw fixed to wall, satin finish.

14.03 BIDET, FLOOR MOUNTED

This shall be made of vitreous china, white color. The overall dimension shall be 370x590 mm. with one tap hole overrim supply bidet with overflow, and one-hole bidet mixer 15 mm. overrim supply pop-up waste, bidet trap 32 mm. and two angle valves with escutcheon 15 mm, and copper tube flexible connections.

14.04 SHOWER TRAY

The shower tray shall be made of white vitreous china 760x760 mm. shower tray with anti-stlipbase and 150 mm. wall height, complete with the following trim and accessories:

- Chrome plated grid waste fitting 15mm.
- Single lever shower mixer 15mm, wall mounted.
- Bath / shower diverter with non return valve in shower outlet.
- Shower rail, 600mm with wall brackets, sliding piece and swivel holder.

14.04 SHOWER TRAY (cont'd)

- Hand shower.
- Shower hose 1500mm, chrome plated.

14.05 WASH BASIN

A. Normal Wash Basin

White, vitreous china, 600 x 500mm pedestal with overflow and single hole faucet, complete with the following trim and accessories:
- One hole single lever mixer.
- Pop-up waste fitting.
- Chrome plated trap 32 mm dia.
- Two angle valves with escutcheon and copper tube flexible connections.
- Soap dish of stainless steel.
- Wall brackets.

B. Countertop Wash Basin

White vitreous china 635 x 500mm with one tophole and overflow, self rimming basin sealed to unit with approved anti-fungus building sealant, complete with the following trim and accessories:-

- One hole single lever mixer 15mm dia.
- Pop-up waste fitting 32mm dia.
- Chrome plated bottle trap 32mm dia.
- Two angle valves with escutcheon and copper tube flexible connections.
- Soap dish of stainless steel.

14.06 CLEANER SINK

Cleaner Sink shall be made of white enameled fireclay and the overall dimensions shall be 465 x 410 x 285mm. it shall be complete with the following trim and accessories:

- Hardwood pad and stainless steel grating.
- Legs and bearers.
- Wall mounted mixer 15mm dia.
- Grid waste fittings 40mm dia.
- Built-in brackets screwed to wall.
- Plastic bottle trap 40mm dia.

14.07 URINAL

Urinal shall be white vitreous china wall mounted type screwed to wall with hangers. The urinal shall be complete with the following trim and accessories:

- Chrome plated domed outlet grating 40mm dia.
- Chrome plated bottle trap 40mm dia.
- Exposed chrome plated flush valve 15mm dia.
- Stainless steel flush pipe and spreader.
- Bowl Supports.
- Vitreous china urinal division 620mm.

14.08 PAPER TOWEL DISPENSER

Paper towel dispenser dispenses 300 C-fold or 400 multi-fold paper towels, and shall be made of 304 stainless steel satin finish. Rough wall opening 300 mm W x 450 mm. H x 100 mm. D.

14.09 HOOK STRIP

This shall be made of stainless steel, and shall be satin finished. The hook shall be 25mm. W. and 165 mm. H. and projecting 57 mm. from wall. It shall be mouting tip 102 mm. H. 61 cm. Length with 3 hooks.

14.10 RAIL TOWEL SURFACE MOUNTED

Stainless steel grab bar for towel holding. Bar dia 25mm. bar gauge 18 with concealed mounting plate.

14.11 STAINLESS STEEL ANGLE FRAME MIRRORS

Framed mirrors one piece roll formed frame shall be 20 mm. x 20 mm., type 304 stainless steel angle with satin finish. The frame shall have continuous integral stiffener on all sides for added strength, and special level design hugs mirror. The corners are heliarc welded, ground and polished smooth No. 1 quality 6 mm. float/plate glass mirror electrolytically copper plated. It shall be guaranteed against silver spoilage for 15 years. Mirror edges shall be protected by 3 mm. thick, waterproof shock absorbing polyethylene padding. 20 gauge galvanized steel back attached to frame with concealed screws, mirror shall be installed on concealed wall hanger and secured in place by two stainless steel locking screws.

14.12 MIRROR SHELF COMBINATION

The angle frame mirror above, furnished with one piece integral shelf. Shelf projects 125 mm. and has 20 mm. edges on front and sides, front return edges hemmed for maximum rigidity and safety. Corners are heliarc welded, ground and polished smooth.

14.12 MIRROR SHELF COMBINATION (cont'd)

Shelf manufactured of type 304 stainless steel with satin finish. Concealed 16 gauge stainless steel brackets attach shelf to mirror frame.

14.13 SOAP DISH

The one piece soap dish shall be made of stainless steel and shall be welded to support arm and flange. It shall have drain holes and two rid gest support bar of soap. The dimensions shall be 115 mm. W. x 50 mm. H. projects 86 mm. from wall.

14.14 SOAP DISPENSER (LIQUID)

Recessed soap dispenser with drawer type soap vessel, unit type. It shall be made of 304 stainless steel with exposed surface satin finish. It shall have a tumbler lock chrome plated non corroding valve to dispense soap, lotions, and detergents. Also it shall have unbreakable refill window. Wall opening shall be 213 mm. x 110 mm. H. x 100 mm. D.

14.15 SHOWER CURTAIN

This shall be vinyl shower curtains, opaque, matte white vinyl 0.2 mm. thick, Nickel plated brass grommets along top, one every 150 mm. bottom sides hemmed 12 hooks required. Length 1600 mm.

14.16 SHOWER CURTAIN RAIL

Stainless steel shower curtain rod with concealed mounting. Rod 0.9 mm. gauge, type 304 stainless steel satin finish 2.5mm. dia flanges 41 mm. dia. Chrome-plated brass wall; polished finish; mounted on concealed wall brackets. Length to be approx. 1600 mm.

14.17 LEVER CONTROL HAND SPRAY

It shall be complete with chrome plated angle valve, one meter metal flexible tube and wall hook.

14.18 WATER CLOSET ARABIAN TYPE

White vitreous china Arabian W.C. complete with the following trim and accessories:-

- 9 liter cistern vitreous china screwed to wall, with PVC flush pipe and brackets.

- Valueless cistern fittings including syphon, bottom inlet ball valve, bottom overflow, right hand lever.

- 15 mm. dia angle valve with flexible copper tube and wall flange.

END OF SECTION

SECTION 15

Above Ground Drainage Installations

DIVISION 15

SECTION 15

ABOVE GROUND DRAINAGE INSTALLATIONS

INDEX

DIVISION 15

SECTION 1500

ABOVE GROUND DRAINAGE INSTALLATIONS

15.01 General Description

The work under this section of the specifications shall include all above ground drainage pipework waste, soil, and rain water, complete with all drains, traps, gullies, cleanouts, vents and all accessories, as shown on the drawings and as specified hereafter.

The above ground drainage pipes shall mean all pipework inside buildings and located as follows:

- Above floor slab
- Under tiles
- In walls
- At high level or low level exposed or concealed
- All vertical pipes (risers)

15.02 Pipe work - General

The pipes and fittings used for above ground drainage installations shall unplasticised polyvinyl chloride UPVC and shall conform BS 4514 and BS 5255.

All change in direction in drainage pipes shall be gradual and not abrupt.

Long sweep fittings and 45-degree fittings, of solvent weld sockets type shall be used.

All pipes shall be plain ended lengths for solvent weld or seal ring connection to all fittings.

Slope of horizontal pipes shall be not less than 1% and not more than 3%.

All pipe jointing and supporting shall be made as recommended by the pipes manufacturer.

All pipes and fittings including adapters, couplings and connectors shall be supplied by the same manufacturer and marked with the manufacturer name, BS. number and diameter.
All pipes and fittings which serves areas of hot effluent waste water such as kitchens, laundries, and CSSD of cast iron to BS 416 or ANSI/A21 spigot or hubless type.

Hubless cast iron system for waste and soil pipe and fittings shall utilize a sleeve-types coupling device consisting of an internally ripped electrometric sealing gasket with a protective corrugated stainless steel shield by stainless steel bands with stainless steel tighting devices.

15.03 Joints and Connections

All joints for above ground drainage pipework, except for expansion joints, shall be made by solvent weld jointing, using the solvent weld cement as recommended by the manufacturer.

Solvent weld socket shall be used to connect two lengths of pipes.

Seal ring coupling (expansion joint) fitted with black rubber seal ring shall be provided for each vertical pipe (not embedded) located between every two floors, and for horizontal pipes (not embedded) at 4.0 m. intervals. The conversion from solvent weld joint pipe to seal ring expansion joints shall be made by adding seal ring adapters.

The connection of UPVC pipes to all water closets shall be made by WC-connector with solvent weld socket and pan seal socket.

Special UPVC connectors and adapters shall be used for connecting the pipes with dissimilar material of other pipes or fittings such as bottle traps, P-traps of plumbing fixtures.

The coupling assembly of cast iron pipes consists of a stainless steel shield, ban and tightening device, and a neoprene gasket, assembled at the factory as a complete unit.

All UPVC pipes which penetrates slabs between two different one hour fire zones, shall fitted with fire protection seals. Such seals shall comprise of sheet metal collars containing an intumescent material which expands rapidly when subjected to intense heat.

The connection between vertical pipes and under-ground pipes shall be made by long radius sockets bend fitted with rubber seal rings.

All hangers and supports shall be of approved types, as recommended by the pipes manufacturer.

15.04 Water Proofing

Where UPVC pipes pass through roofs, they shall be provided with UPVC weathering apron and slate to make watertight seal around the pipes at roof level.

The method of water proofing shall be made as per the manufacturer instructions.

15.05 Cleanouts

- Cleanouts shall be installed, to provide access to waste and soil pipes for inspection or cleaning. All cleanouts types shall be UPVC.

- Cleanouts shall be provided as shown on the drawings, at or near the foot of every vertical stack and no long horizontal pipe tuns at every 15 meter intervals.

15.05 Cleanouts

- Cleanouts on horizontal pipes (not buried) shall be UPVC access cap solvent weld to any socketed fitting fitted with screw cap and washer complete with PTFE tape to seal thread.

- Cleanouts on horizontal and vertical pipes (not fitted to the fittings), shall be made by access pipe with 75 mm. diameter, opening for access and sealed with screwed cover.

- All fittings used for the connection between horizontal pipe and vertical pipe (not buried) shall be fitted with access doors secured by two zinc plated screws and captive nuts.

15.06 Floor Drain – TYPE (FD)

The floor drain type (FD) shall be UPVC trapped floor gully with 110m. dia. top socket, three side inlet sockets, and one 75 mm. dia. outlet socket equipped with screwed plug for rodding.

Each side inlet socket shall be 50 mm. dia. blanked off and must be cut out of inlet used.

The top socket shall be fitted with 110 mm. dia. raising piece with a 150 mm. square top to suit standard floor tiles, together with a snap-in cover that provides channel for disposal of surface water.

15.07 Floor Drain – TYPE (FD-1)

Floor drains type (FD-1) shall consist of 100 mm. dia. UPVC p-trap, stainless steel strainer size 200 x 200 mm and connecting pipe piece between p-trap and strainer.

15.08 Roof Drain - TYPE (RD)

Roof drain shall be UPVC Domed type supplied with socket outlet of size to fit with the rainwater pipes as shown on the drawings.

Roof drain shall be complete with removable domed grid, screws and polypropylene washer.

Roof drains shall be installed and fixed in accordance with the manufacturer instructions.

15.9 Balcony Drain - TYPE (BD)

Balcony drain shall be UPVC supplied with socket outlet of 90 mm (3") diameter.

Balcony drain shall be complete with grid, screws, washers and spacer.

Balcony drains shall be installed and fixed in accordance with the manufacturer instructions.

15.10 Roof Vent Cowl -TYPE (RVC)

Roof vent cowl shall be provided for all vent pipes as shown on the drawings.

Roof vent cowl shall be UPVC with screened cap and connected to the vent pipe by solvent welding.

15.11 Testing

The work shall be inspected and tested during installation.

All work which will be concealed shall be tested before it is finally enclosed.
A final test shall be made upon completion of the work for soundness and performance in accordance with BS 5572: 1978 Code of practice for Sanitary Pipework.

END OF SECTION

SECTION 16

Below Ground Drainage Installations

MECHANICAL WORKS

SECTION 16.00

BELOW GROUND DRAINAGE INSTALLATIONS

INDEX

MECHANICAL WORKS

SECTION 16.00

BELOW GROUND DRAINAGE INSTALLATIONS

16.01 GENERAL DESCRIPTION

The work under this section of the specifications shall include all underground drainage pipework complete with gullies, traps, cleanouts, manholes, and all accessories, as shown on the drawings.

Below ground drainage pipework shall mean all pipework located under ground floor slab inside buildings and all external pipe network.

16.02 PIPEWORK - GENERAL

The pipes and fittings shall be unplasticised polyvinyl chloride UPVC.

Pipe size 110 mm. and 160 mm. shall conform to BS 4660, and size 200 mm. up to 630 mm. shall conform to BS5481.

Pipes and fittings shall be manufactured with polyproplene seal retaining caps.

All joints for below ground pipework shall be made by seal ring expansion joint.

16.03 PIPEWORK - INSTALLATIONS

16.03.1 EXCAVATION

All excavations shall be formed with vertical sides and of not greater dimensions than stated in this specifications, with allowance for timbering, shuttering or other necessary temporary work.

Excavation beyond theses dimensions for any convenience of the contractor will not be permitted and should any excavation exceed the width or depth stated, to the detriment of the support or foundation of any of the works, the contractor shall refill such extra with C7.5P concrete or as directed at his own cost.

The sides of trenches, manholes and other excavations shall be adequately supported at all times.

Any material excavated in forming pipe drains shall, if found unsuitable, be run to spoil and replaced with suitable approved material. All suitable excavated material shall be used as backfill except in French drains.

Timber, sheeting, piling, struts, wallings and bracings may only be left in the excavations if so directed.

The formations of all excavations are to be cut and trimmed to the exact lines, levels and depths as shown on the drawings, or to such other lines, levels or depths as directed.

Where a concrete or granular bed or surround is required to the pipeline, manhole etc, the excavation shall be taken out to the overall dimensions of the bed or surround. The sides of the trench shall be vertical with no undercutting.

Where pipelines are to be laid pipe on granular bed the concrete fill to over-excavation shall be shuttered to provide the trench width specified, up to 300mm above the barrel of the pipe.

Where pipes are to be laid at or below existing ground level underfill, and there is less than 1.2m of existing ground above the pipe crown, the fill shall be completed to a depth of 1.2m above the crown of the pipe, and the trenches excavated in fill material for such pipelines and associated structures.

Soft spots shall be removed from the bottom of the trenches and other excavations, which shall then be refilled to formation level with the same material and compaction as the permanent work, which is to rest on their formation. Any void which results from over excavations below formation level shall refilled in the same manner.

All excavations shall be cleared of water both by day and by night, and shall be shaped to prevent any accumulation of water either in or adjoining the excavation or the spoil therefrom.

Sumps shall be constructed and maintained clear of all excavations for permanent works, so that water at all times must be kept below any permanent works in the course of construction.

Ground water and water arising from construction shall be maintained away and not permitted to enter the permanent drainage systems.

Excavated materials which is suitable for use as a backfill shall be adequately protected to maintain its suitability for reuse.

Excavated materials or any other materials shall be placed at as safe distance from the excavation and shall not be placed closer than a horizontal distance equal to the depth of the excavation, unless suitable working and safe arrangements are made.

16.03.2 SUPPORTS FOR EXCAVATIONS

All excavations shall be supported and secured to ensure the proper execution of the works and to prevent any settlement of the adjoining ground or structures thereon.
Systems of timbering using poling boards, runner or steel trench sheeting shall be used according to the ground conditions and shall be designed to prevent loss of ground during excavation and to ensure that backfilling can be carried out in accordance with the requirements, leaving no voids.

16.03.2 TRENCH WIDTHS (EXCLUDING LAND DRAINS)

From the bottom of the trench to a level 300mm above the crown of the pipe, trench widths shall not be less than the minimum nor greater than the maximum figures shown in the table below.

Pipe Nominal Diameter (mm)	Minimum Trench Width (mm)	Maximum Trench Width (mm)
100	450	525
150	490	600
225	580	700
300	680	750
375	950	1050
450	1030	1150
525	1120	1200
600	1240	1350

Irregularities and overbreak shall, unless otherwise agreed prior to the commencement of permanent work, be made good to the correct dimensions with concrete as specified.

16.03.3 DRAINAGE PIPE LAYING

16.03.3.1 GENERAL

The installation of pipework shall be carried out in accordance with the requirements and recommendations of BS. 8301 unless more stringent requirements are stated in this specifications..

Before the commencement of the pipe layouts, the position and level of the drains or sewer to which it is proposed to make a connection shall be confirmed, if necessary by excavation.

16.03.3.2 LEVELS

All pipes shall be laid truly straight lines in directions and gradient between manholes, rodding eyes access chambers.. etc. Bends shall be provided where shown on drawings and, in the event of any variations in the position of any manhole of the line of the sewer being considered necessary, the works shall be constructed as directed,

The allowance on given invert levels shall be ±5mm provided that the as laid gradient of the pipes runs between successive given invert levels shall not vary by more than 10% from that shown on drawings and provided that the relative level differences between pipes in an individual installation are maintained. The plan setting out shall be within ±5mm of the drawing dimensions.

Pipes shall be laid within the whole of the barrel of the pipes evenly and solidly supported by bedding materials, with shaped holes in the receive the socket. After making the joint, the bedding material shall be carefully packed around the joint to fill the void in the bed left joints.

Hard packings shall not be used as permanent or temporary pipe supports; nor shall pipe spigots be permitted to bear on socket inverts in such a manner as to produce uneven pressure on the joints.

Notwithstanding the flexibility provided in the pipe joints, pipes must be securely positioned to prevent movement during and after the making of the joint.

The space between the end of the spigot and the shoulder of the socket of flexibly jointed pipes when jointed shall as recommended by the manufacturer..

Joints shall be made strictly in accordance with the manufacturer's instructions, using the technical advisory services offered by the manufacturer for instructing the pipe jointers in the methods of assembling joins. Where manufacturer recommend the use of special jointing tackles, these shall be used for the assembly of all joints to pipes,

16.03.3.3 PROTECTION

Immediately after flexibly jointed socket and spigot pipes have been tested, the gaps between barrels of the pipes and the internal face of the socket shall be sealed with puddle clay or other suitable flexible materials to prevent the ingress of the bedding and fill materials.

All pipe end which are left open during the contract shall be temporarily fitted with propriety end caps as supplied by pipes manufacturer, Where these are not available, expanding stoppers shall be used. Adequate precautions shall be taken to prevent floatation of the pipeline.

Pipes shall not be burried at less than 600 mm. below finished grade for protection against mechanical damage.

Pipes shall not be run closer than 1 m. to building bearing walls and footings for protection against building settlement.

Pipes shall be kept clean until final acceptance of the work. Exposed ends of all incompleted lines shall be closed with wooden plugs and adequately secured at all times when pipe laying is not actually in progress.

Pipes shall be installed on a good foundation and adequate means taken to prevent settlement. Pipes laid in trenches shall be provided with a solid uniform bearing throughout the entire length.

16.03.3.4 DRAINAGE THROUGH STRUCTURE AND MANHOLE WALLS

There shall be two flexible joints at each point, where the pipe lines is built into and supported by the structure or manhole/instructions, positioned at 150mm and 750mm from the face of the structure.

16.03.3.5 DRAINAGE UNDER BUILDING

Where drain trenches are to be excavated beneath foundations or below the level of adjacent foundations, the sides of the excavation shall be supported by such substantial planking and strutting as steel trench sheeting driven plumb in advance of the excavation proceeding. The trench sheeting shall be carefully withdrawn after compaction of the backfill material so as to cause the minimum disturbance to the backfill and adjacent ground.

Where the top of a pipe of equal to or less than 150mm diameter is within 300mm of the underside of a concrete slab or footing, the pipe shall be bedded and surrounded in 200mm of canned concrete.

16.03.3.6 DRAINAGE THROUGH STRUCTURE AND MANHOLE WALLS

There shall be two flexible joints at each point where the pipe lines is built into and supported by the structure or manhole/instructions, positioned at 150mm and 750mm from the face of the structure.

Where conditions necessitate that the drop would exceed 450 mm. at the maximum slope of 3%, a drop manhole shall be used, of detail as shown on the drawings.

All joints shall be inspected and an inspection of the lines as a whole shall show all pipes to be true to line and grade with full moon circle visible at the manholes.

If an inspection of the completed sewer or any part thereof shows any structures, pipes or joints which are defective, the defective work shall be replaced or repaired as directed.

16.03.3.7 SUB-SOIL DRAINAGE

Subsoil drainage pipe work shall extended around the buildings and in the site green beds to effectively drain the exceeded water tables levels and remove subsoil moisture.

Subsoil drainage shall be made using open jointed, porous, or perforated pipes.

The main pipes should be of 100mm bore and the branch pipes shall be of 75mm bore.

The pipes shall be laid at between 600mm to 900mm in heavy soils, and deeper in light soils and the gradient rather by the fall of the land than by consideration of self cleansing velocity.

Subsoil water shall be discharged into soakaway pit or through a catch basin into the nearest ditch or into a surface water drainage system.

16.04 BEDDING AND SURROUNDING OF PIPES BENEATH BUILDING

a. All pipes shall be bedded on 20 N/mm. concrete and shall be supported at the concrete cradles placed behind the sockets or on each side of the joint by methods approved by the Engineer. The supports shall be provided with soft contact padding such as roofing felt or other approved material.

b. The annular gaps in flexible joints shall be sealed with approved means to prevent the intrusion of concrete. The pipes to be in contact with concrete shall be washed clean of any mud or clay.

c. Concrete shall be gently and evenly placed over the entire width of the trench of bedding as shown on the drawings, and to within 25 mm. of the bottom of the pipe. Then, without stopping, it shall be placed gently on the side of the pipe only and carefully worked under the pipe, ensuring that no voids are left below the pipe. Concrete shall the be brought up equally on each side of the pipe to the required finished height, care being taken not to force the pipes off their supports.

d. No fill material shall be placed over the concrete until the concrete has reached a crushing strength of 14 N/mm2. The concrete and the pipes shall be kept damp and protected from sun or frost until the concrete has reached the required strength for filling to take place.

16.05 BEDDING AND LAYING OUT OF DRAIN PIPES - EXTERNAL

a. Immediately following the trench excavation, the pipes shall be laid and jointed on pipe bedding material.

b. The pipes shall be laid so that one is in contact with the bed throughout the length of its barrel. Bedding material being scrabed away at each socket so that the socket does not hear on the bed. Pipes and channels shall be laid with the sockets leading up the gradient. All drainage runs shall be commenced at the point of outfall or at a manhole.

16.06 BEDDING AND SURROUND OF PIPES - GENERALLY

After jointing the pipes, the bedding shall be brought up equally on both sides of the pipe, first to the level of the centre of the pipe line and then up to a height of 300 mm. above the top of the pipe barrel. This material shall be placed in layers not exceeding 150 mm. in thickness and shall be carefully compacted with wooden rammers.

16.07 BACKFILLING OF TRENCHES

a. All backfilling shall, as far as practicable, be undertaken immediately after the specified operations preceding it have been completed.

b. The backfilling shall be undertaken only after completion of testing for such pipes as described herein. From 300 mm. above the barrel of the pipe up to the formation level of the road, the filling in the trench shall continue with selected approved material from excavations, in layers not exceeding 150 mm. in thick. Each such layer shall be solidly rammed before the next layer is added.

c. Where the drain does not run under a road, the backfill material shall be solidly rammed up to the existing ground level in the manner described above.

16.08 MANHOLES - GENERAL

Manholes shall be of precasted in place reinforced concrete construction and shall be of details shown on the drawings.

Manholes shall be constructed to the required depth. The manholes top shall have 600 x 600 mm clear opening and shall be shaped to accommodate a standard size manhole frame and cover.

Manhole floors shall be formed with rich cement mortar to the size and shape of the sewer. Inverts shall have a cross section of exact shape as the sewers and all changes in sewer size shall be made gradually and evenly. The floor shall have a gradual slope from the side walls to the central channel.

16.09 BENCHING AND INVERTS OF MANHOLES

The open channel in the bottom of the manholes shall be formed in the benching with half round of pipe. All side branches shall be connected to the main channel so that the discharge is in the direction of the flow in the main channel. The benching shall be concrete and shall rise vertically from the edge of the channel pipe to a height not less that the outgoing pipe and be sloped upwards from there to meet the wall of the manhole at a gradient of about 1 in 6. Rendering to benching shall be applied in a coat of cement mortar (1:1) to a final thickness of 20 mm trowelled to a smooth hard finish in accordance with BS. C.P. 301.

16.10 TEMPORARY COVERS FOR MANHOLES

Temporary covers shall be fitted and retained in position on all manholes from the time the top access is formed or the concrete cover slab installed, until the permanent cover is installed.

16.11 MANHOLE STEP IRONS

All manholes of depth greater than 1200 mm. shall be provided with galvanized steel irons complying with BS. 1247. They shall be staggered in two vertical runs at 300 mm. centers vertically and 225 mm horizontally.

The top iron shall be no more than 350 mm. below the underside of the manhole cover slab and the lowest no more than 300 mm. above the benching. Manhole cover frames shall be bedded in 1:3 sulphate resisting cement sand mortar.

16.12 FRAMES AND COVERS

The Contractor shall provide for each manhole cast iron frame and cover with a 600 mm diameter clear opening. the concrete masonry shall be neatly and accurately brought to the dimensions of the base of the frame. the frame shall be thoroughly embedded in mortar and frame and cover set level and to the proper grade.

All castings for frames and covers shall be of tough grey iron and shall be made accurately to dimensions and machined to provide even bearing surfaces. Covers shall fit the frames in any position and if found to rattle under traffic shall be replaced. No plugging, burning in or filling to obtain tight covers will be allowed. All castings shall be carefully coated inside and outside with coal tar pitch varnish of approved quality.

All frames and covers shall comply with BS 497 of grads as indicated on the manholes schedules.

All manholes covers shall be provided with at least two keyways.

All covers and frames shall have clearly cast thereon the number of BS., the appropriate grade and the weight in kg.

16.13 TESTING OF DRAINS

General

Unless more stringent requirements are stated in this specification, all testing shall be carried out in accordance with 8301.

a. The Contractor shall provide the necessary labour and equipment and include in his Tender for testing and work to the requirements and satisfaction of the Engineer and all relevant public authorities.

b. All drains and sewers shall be tested with air after being laid and jointed but before surround and backfilling is commenced to ensure that the jointing is satisfactory. The results of the test must be approved by the Engineer before connecting.

The air test shall be applied at a pressure equivalent to 100mm head of water shall be held for 5 minutes without further pumping; with loss not exceeding 25mm for satisfactory testing. Where gullies or other ground floor appliances are connected, a 50mm test should be applied with a maximum loss of 12mm over a 5 minute period..

A gauge in the form of a glass 'U' tube shall be provided and connected to the drain plug of the length of drain under test.

c. A further water test shall be carried out after the completion of the backfilling and manhole construction, the length tested being between manholes.Test shall be carried out in the manner described in the following paragraph.

d. To facilitate the general building programme, tests shall be made of sections as the work proceeds, such testing however will not absolve the Contractor from his liability for any subsequent or final testing.

e. Any defects that become apparent during these tests of any part or parts of the installation shall be rectified at the Contractor's expense and the part, or parts, retested to the satisfaction of the Engineer and the relevant public authorities.

f. For a water test, the drain lines shall be subjected to test pressure of 2.5m. head of water at the highest point of the section under test. Allowance should be made for added water until absorption has ceased, after which the test proper should be commenced and the water level be maintained for a minimum of 30 minutes without the addition of further water.

The same diameter as the drain at end, shall be fitted temporarily, in the socket of the last pipe laid the joints being made water tight. The length under test shall be fitted with water. The length under test shall be filled with water and after allowing for 2 hours absorption and topping up,. the water level in the pipe shall be observed for 30 minutes. The test shall be regarded as satisfactory if the loss of water does not exceed:

Pipe Diameter (mm)	Water Loss (liter per meter run)
100	.05
150	.08
225	.12
300	.15

g. Test for straightens and obstruction shall be made to the Engineer's satisfaction and in accordance with the requirements of B.S.C.P. 301, Building Drainage.

h. The whole of the installation shall be left clean and free from debris.

i. The Contractor shall keep a record of the tests carried out on the drainage installation throughout the Contract, recording date of test, by whom tested and the result, one copy of the records shall be sent to the Engineer on completion of the Contract.

16.14 TESTING OF MANHOLES

Manholes shall be subjected to a hydraulic test. Pipe stoppers shall be inserted into all pipe ends and the manhole filled with water to a height of 1500 mm above the benching invert. This water shall stand for five minutes for absorption to take place and then be topped up as necessary. The water shall then remain at this level for a further two hours to satisfy the test. If the water level falls, then all defects shall be made good to the satisfaction of the Engineer, and the test shall be repeated as many times as may be necessary until the manhole is satisfactory.

16.15 WET PIT SUBMERSIBLE SUMP PUMPS

Submersible pumps shall be of the single stage centrifugal type. The pump shall have cast iron body, stainless steel shaft and stainless steel impeller. The squirrel cage

motor shall be suitable for the building electrical supply and submerged operation. The type of starter for motor shall be star delta.

Each set of pumps consisted of two number macerating pumps (submersible type / explosion proof) configured as duty/standby. Pumps shall alter in operation sequentially. Standby pumps shall operate by very high level switch.

All studs, bolts, nuts, screws and washers shall be of stainless steel. Each set of pumps shall be complete with adjustable level controller, control panel, non-return valve in each discharge line and lifting handle and chain.

The control panel shall be complete with the following:-

- Normal housing
- Start/stop buttons
- Individual pump run lights
- Individual pump stop lights
- Individual pump trip lights
- Supply on lights
- Minimum run timers
- Hand auto/On/Off switch
- Volt free "fault" contact for remote control

The control panel shall incorporate thermal overload protection with automatic reset provision.

The submersible pumps shall be located within the wet section in the pumping chamber, complete with guide rails for ease of removal for maintenance / repair.

The sump shall be provided with level controls for operation of the pump units as well as at very high and very low level alarms indication.

The sump shall be provided with access covers, step cast iron and sump vents.

Local isolators shall be located adjacent to the sump for isolation of units during maintenance.

Pump isolating valves and test points shall be added to each set of pumps.

16.16 LOCAL REGULATIONS

All works shall be carried out to comply with the current local public health regulations, the latest BS 5572/BS 8301 and current local by-laws and shall be to the entire satisfaction of the Engineer.

END OF SECTION