Federal Electricity & Water Authority

Water Directorate
Asset Management Department

STANDARD SPECIFICATIONS
FOR WATER WORKS

TECHNICAL TERMS

Chapter – 4
Engineering Specifications
[C-Civil Engineering Works Specifications]

CS19-Sanitary/Kitchen Installations
### CS19-Sanitary/Kitchen Installations

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1.   GENERAL
CS19-Sanitary/Kitchen Installations

A. SANITARY INSTALLATIONS

1. GENERAL

The work under this division comprises the design, supply and installation of the complete plumbing system and sanitary works.

The plumbing works consisting of all water supply to and water discharge from all the sanitary fixtures in the buildings.

Hot water is generated by individual electric water heaters, drainage is discharged by gravity from individual points to risers which are connected by a system of manholes to the main sewer line or septic tanks.

The Contractor shall prior to commencement of the works, prepare and submit to the Engineer detailed drawings, indicating the layout and schematic diagram of all pipings, fittings and valves, to position of sanitary fixtures, floor drains, etc. Piping shall be indicated by diameter, slope and invert level. Outside the building, connection points to general water distribution and drainage system shall be provided. The costs and charges for the connection of all permanent services shall be borne by the Contractor.

2. CAPACITIES RATINGS, SIZES AND QUANTITIES AND MATERIALS

The capacities, ratings, sizes, quantities and materials specified in chapter-1 Specific requirements of the project and in this specification are to be considered as the minimum requirements to be provided. It is the responsibility of the contractor/manufacturer to determine the required capacities, rating, sizes and quantities and select the appropriate material based on the guidelines given in this specifications.

If the evaluated requirements are higher than the minimum specified requirements, then the required capacity/rating/size/quantities equipment shall be provided. If the evaluated requirements are less than the minimum requirements then the minimum requirements shall be complied.

Any discrepancy in capacities, rating, sizes, quantities, and specified materials in Specific requirements of the project and specifications, then the requirements given at the specific Requirements of projects shall prevail.

3. STANDARDS AND CODES (To include all latest amendments)

- BS EN 12201: Plastic piping systems for water supply. Polyethylene (PE). General
- BS EN 1057: Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications
- BS 4660: Thermoplastics ancillary fittings of nominal sizes 110 and 160 for below ground gravity drainage and sewerage
- BS EN 13598: Plastics piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE).
- BS EN 1401: Plastic piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U).
- BS EN 1796: Plastics piping systems for water supply with or without pressure. Glass-
reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP).

B.S. 4943 Plastic waste traps
B.S. 4514 UPVC soil and ventilating pipes
B.S. 8000 Code of Practice for above ground drainage Part 3 and sanitary appliances
BS EN 124 Gully tops and manhole tops for vehicular and pedestrian areas.
BS EN 19 Industrial valves.

4. MATERIALS

All materials and structural components to be supplied, erected, or installed by the Contractor and, ultimately incorporated in the Work, shall be new and unused and of selected quality approved by FEWA/Engineer. They shall appropriately match to each other. All materials and structural components not standardized shall be used only with the approval of FEWA/Engineer.

All materials and accessories for piping, valves, and fittings shall be of the best grade and quality to suit the requirement. All manufactured item shall be standard commercial products of reputable manufacturers.

Prior to placing order, the Contractor shall submit a description and/or drawings showing all technical characteristics, make, type and address of manufacturer, etc., of the offered materials for approval by the Engineer.

All materials shall be in accordance with ISO, BS, ANSI, DIN or other accepted standards. Minimum quality requirements of materials used in civil engineering works.

- UPVC pipes made to BS 4514
- Copper pipe made to BS EN 1057
- PVC pipes made to BS 4660, BS EN 13598/BS EN 1401
- GRP pipes made to BS EN 1796
- Ductile cast iron pipe made to ISO 2531
- Chemical resistant to specific chemical discharges

5. GENERAL REQUIREMENTS

The general requirements for the sanitary installation works shall be specified as follows without being limited to it.

- Potable water pipes (cold and warm) inside the buildings from the installation pit up to the fixtures.
- Copper pipes type L, shop insulated for both on and under plaster use, diameter 12 to 50 mm, including all required fittings; nominal pressure NP 10 (10 bar).
- Insulated 200 gallon GRP water supply tanks in housing located on the roof of the buildings.
- Storm water, sanitary sewer pipes and ventilation pipes inside the buildings.
- UPVC or GRP pipes, diameter 50 to 200 mm, including all required fittings.
- Polyethylene pipes for potable water supply outside the buildings up to the installation pit located 1 m outside the buildings.
- Sanitary fixtures such as washbasin units, WC sets, storage water heaters, etc., according to relevant drawings and technical specification, including all auxiliary materials and works.
6. **SANITARY FIXTURES**

All fixtures specified as hereinafter and shown on the plans shall be furnished and set by the Contractor in a neat and finished manner, making connections with all supply, waste, soil, electrical connections and vent pipes complete in every respect.

Supply and install all sanitary fixtures as shown on the drawings and specified in the specifications. Vitreous china fixtures shall be of first quality with smooth glazed surfaces, free from warp, cracks, discolorations or other imperfections. Fixtures shall be set in a neat; finished and uniform manner making the connection to all fixtures at right angles to the wall of concealed holding type, unless otherwise directed by FEWA/Engineer. Fixtures are not to be set until so directed by the ENGINEER. Ample application of petroleum jelly shall be applied to all surfaces of exposed chromium plated piping, valves and fittings and stainless steel fixtures immediately after installation.

Concealed brackets, hangers and plates shall have a shop coat of paint. All exposed piping and trim shall be chrome plated and fully protected during installation. Strap or padded wrenches shall be used on chrome pipe fittings and valves. All exposed metal parts in toilet room and shower room shall be chromium plated. All valves in toilets shall be chrome placed recessed type. The location and disposition of all items shall be as indicated on the approved drawings, and to the approval of FEWA/Engineer.

7. **EXECUTION OF WORK**

7.1 General

All parts of sanitary installations shall suitably be adapted to each other so that the required performance is achieved, safety in operations ensured and corrosion processes largely reduced. The Contractor shall prepare installation, foundation, slot and penetration drawings based on the construction drawings and shall reconcile these with FEWA/Engineer’s requirements. Any existing slot and penetration drawings shall be checked by the Contractor.

Where pipe routing is left to the Contractor’s discretion, he shall after receipt of the guide drawings from FEWA/Engineer shall prepare the detailed and accurate pipe arrangement plans and obtain the Engineer’s approval early enough to ensure that the necessary slots and recesses can be provided during the concrete works.

The Contractor shall arrange for any approvals and acceptance required for execution of the works. The local regulations concerning connections to utility lines shall be complied with. In carrying out the works, the manufacturer’s installation instructions and laying directions as well as any restrictions of use shall be followed.

For pipe connections not made for longitudinal forces, e.g., socket joints, in which an internal pressure normally exists or may arise owing to particular operating conditions, the Contractor shall, especially at changes of direction, secure the pipes against sliding apart (at pressure tests and under operating conditions) by fixing them to abutments. All reaction forces from expansion members, compensators, and vibration dampers shall be absorbed by fixed points in the piping.

At junctions with other lines, specifically electric cables, and heating pipes these shall be protected from damage and adverse influences as the respective line or pipe may require.
The Contractor shall prepare the operating instructions required for the proper and safe operation of all plumbing and sanitary plant or parts thereof. He shall submit these to the Engineer upon final takeover of the plant together with as-built drawings, schematic diagrams, and descriptions of the installed plant, as well as manufacturer’s maintenance instructions. Any cutting, drilling and milling works for penetrations and slots as well as for fixing the structure shall be carried out only with the Engineer’s prior consent.

7.2 Pipes and Fittings
Copper pipes to nominal pressure NP 10 (10 bar) shall be generally used for potable water. Inside the building, the pipes shall be embedded in the walls except where distribution pipes are installed in the suspended ceilings or in such cases FEWA/Engineer decides to install surface-mounted pipes. Piping shall be shop-insulated with polystyrene or other approved material. All exposed parts must be chromium-plated. Distribution piping shall be laid out as to avoid formation of permanent air bubbles in the lines. De-aeration and drain devices shall be provided. Blockouts and drilling of holes for pipes and all necessary fastening of pipes, ducts, and other equipment, concreting in and touching up shall be included in the prices for the various items for Sanitary Installation.

Pipes and fittings to be embedded in concrete shall be held firmly in position and protected from damage while the concrete is being placed. No wood supports shall be embedded in concrete. In the installation of all piping, care shall be taken to prevent the piping from becoming clogged during the progress of the work and should any pipe become either partially or wholly clogged before final takeover of the work, it shall be cleaned out by the Contractor in a manner satisfactory to the Engineer or shall be replaced by and at the expense of the Contractor. Open ends of pipe shall be plugged or otherwise suitably closed when work is suspended for any reason.

Unless otherwise indicated on the drawings, vertical pipes shall be plumb, horizontal pipes shall be level, and where two or more adjacent pipes extend in the same direction, they shall be parallel. Pipes passing through floors, walls, ceilings, and partitions shall be run through metal sleeves of the proper diameter and the annular space between the pipe and the sleeves shall be caulked.

All embedded piping shall be installed to the correct elevations, gradient, and alignment as shown on the drawings, or as directed by the Engineer. Insulating of pipes shall be made in accordance with the state of the art rules.

All pipes shall be cut accurately to measurements established on the job and shall be worked into place without springing or forcing, unless cold springing is specified. Connections to equipment shall be made so that no stress will be placed thereon because of improper alignment or hanging. Certain equipment will require special piping provisions, and the Contractor shall comply with all manufacturer’s instructions in this respect. Inside building, the main trunk shall be equipped with two isolating valves and one non-return valve. At least two breather-and-aerators shall be provided at the highest point of the piping.

Pipe work shall be installed in a manner to allow for ease of air escape and system draining. It shall be endeavoured to obtain this naturally by gravity. However where conditions do not permit this, an automatic air vent shall be installed at all air pocket locations.

All required fittings, such as full-bore valves, non-return valves, angle valves, strainer, discharge taps, etc., shall be made of red brass or other material, if approved by FEWA/Engineer. Special equipment, such as pressure gauges, pressure reducing valves, sight flow gauges, shall be installed in accordance with the manufacturer’s directions. No separate payment will be made for
installing instruments, gauges, and valves that are furnished with equipment, but shall be included in the unit price for installing the equipment of which they are a part.

All valves shall be installed vertically except where lack of clearance space or where accessibility requires otherwise or where specified. Great care shall be taken in setting out and determining the general levels and falls of drain pipes, so that a fall giving a self-cleaning velocity shall be obtained. Drainage pipes shall be installed with a slope of not less than 1%. Before the installation of any pipe, it shall be internally cleaned from dirt, sand, debris, etc.

The drain shall be laid truly straight in line and gradient so that a light held at one end of the pipe may be seen truly concentric from the other end, the full bore of the pipe showing.

The Contractor shall provide all necessary stoppers, etc., and shall test the drains and pipes in the presence of the Engineer as often as required, by filling them with water (for the water supply pipes under a pressure of 10 bar).

If any piping is found to be unsatisfactory in any way, the relevant part of it shall be removed and relaid at the Contractor's expense. Before covering the pipe work, pressure test must be carried out to the satisfaction of FEWA/Engineer.

Sleeves shall be supplied and installed wherever pipes go through slabs, walls, partitions, etc. Sleeves shall be cuts of pipes having an internal diameter of not less than 10mm. larger than the external diameter of the sleeved pipe or the insulated sleeved pipe depending on the particular situation.

Floor sleeves shall protrude about 20mm. above the finished floor level. All gaps shall be plugged with a non-flowing, plastic and water proof master paste. All pipes shall be installed complete with:
- Metallic supports.
- Unions, couplings, elbows, tees, crosses, reducers, caps, etc.
- Automatic air vents.
- Drain valves where necessary.
- All cutting, patching and making good of walls, slabs, partitions, etc., connection with fixings, supporting and anchoring of pipes.
- All connections and fixing to equipment and accessories.

7.2.1 UPVC Pipes
The pipe shall be homogenous throughout and free from visible cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practicable in colour, capacity, density and other physical properties. All fittings and accessories shall be of same material and quality as the pipe and jointing shall be of the spigot and socket cemented type where solvent cement is applied to both parts. After pushing the pipe into the socket the joint shall be allowed to set for at least 10 hours.

7.2.2 Copper Pipes
All Hot and Cold water installations shall be made using copper pipes. Copper pipes shall be of the seamless hard drawn type. Pipes of appropriate types shall be used for underground and over ground installation. Fittings shall be of the same material and weight as the pipes and shall be suitable for soldering jointing pressure type. Heating and finishing of the joint shall be done in accordance with the recommendations of the Manufacturer/Supplier of the fittings, using solid string.
or wire solder composed of 50 percent lead for inside and 95 percent tin and 5 percent antimony for underground.

7.2.3 Underground Drainage Pipes
All pipes connecting manholes shall be 150mm diameter and conform to BS 4660 for unplasticised PVC underground drain pipe and fittings. Fittings shall be injection moulded of rubber ring seal integral mechanical joints.

7.2.4 Floor Drains
All floor drains as specified herein shall be supplied and installed wherever required by the drawings. Each floor drain shall be of heavy duty UPVC with "S" or "P" trap complete with chrome plated heavy duty, 200 x 200mm. bronze strainer. The strainer shall be screwed to the body of the drain. All floor drains shall have chrome plated removable covers to their strainers or heavy duty aluminium cover.

7.2.5 Clean Outs
All clean outs as specified herein shall be supplied and installed wherever required by the drawings. Each clean-out shall be of the same material and dimensions as the pipe to be cleaned, and shall be placed in walls, slabs or floors as needed for ease of operation. Where cleanouts terminate in floors, a bronze cleanout tile 200 x 200mm. with screwed cover shall be provided. Tile and cover shall be chrome plated.

7.2.6 Vent Caps
Vent caps on all waste, soil and vent stacks shall be supplied and installed wherever shown on the drawings and in accordance with this specification. Each vent cap shall be of UPVC and shall be solvent cemented onto the waste, vent and soil stack.

7.2.7 Insulated Copper Pipes
All hot water copper pipes shall be insulated with 12 mm thick aluminum foil backed glass fibre insulation, wrapped with aluminum tape. Pipes running under tiles shall have an additional cover of cement-sand mortar with no lime. All cold water pipes shall be provided with an anti-condensate insulation, complete with vapour seal.

7.2.8 Gate Valves
Gate valves shall be all bronze, screwed ends, union, bonnet, wedge disc type. All valves in toilet rooms and shower shall be chrome plated recessed type, having the same handles as the fixtures, one main isolating valve should be supplied and filled in every toilet, bathroom, kitchen and kitchenette, on each of the hot and cold water supplies.
One gate valve shall be supplied and installed.
- At the bottom of each riser and all low points to be drained.
- At all other points shown on the drawings and/or specified.
All gate valves at the outlets of water tanks shall be of the outside screw and yoke type.

7.2.9 Check Valves
Check valves shall be bronze screwed ends and screwed cap with lift check, renewable composite disc and seat.
- At the inlet pipe of all Water Heaters.
- At all points shown on the drawing and/or where specified.

7.2.10 Float Valves
Float valves shall be all bronze, screwed ends, float operated. Float shall be all copper and mounted at the end of a brass or copper rod, which actuates valve operation.
7.2.11 Automatic Air Vents
All automatic air vents shall be supplied and installed as shown on the drawings and wherever specified herein. Automatic air vents of the ball float type shall be installed at all high points in the piping. A 12 mm lock shield valve shall be installed directly ahead of each automatic air vent, and a 12 mm drain line shall be provided to discharge at a convenient point.

7.2.12 Unions and Flanges
Unions and flanges shall be installed at all equipment inlets and outlets, at all valve inlets or outlets, on all pipe branches and in general, every 15 meters of pipe run. Unions shall be used on all screwed pipes and shall be of the same quality and service. Flanges, suitable for welding, shall be used on all welded pipes, and shall be all steel construction to ASTM or BS Standards. Threaded flanges shall be used on all threaded pipes. When flanged valves and equipment are connected to the pipes, flanges shall be of the same quality and service as the pipe served, and shall conform to ASTM or BS Standards.

7.2.13 Hangers and Supports
The pipes hangers shall be of the individual or trapeze type as conditions require, and shall be constructed of structural steel and steel hanger rods with adjusting nuts. Horizontal copper pipes shall be supported at not more than 2 meters apart, and horizontal PVC pipes shall be individually supported. All horizontal pipes shall be supported at all changes in direction to insure a maximum deflection of 3 mm. Vertical pipes shall be provided with heavy iron clamps one at every floor level. Piping shall not be hung from other piping, and no wire, tape, or metal bands shall be used as substitute for hangers. Hangers and supports shall be secured to the structure by providing inserts in the concrete or by means of fish plates in case of heavy loads.

7.2.14 Jointing of Pipes
Jointing of pipes shall be made according to the different kinds of pipes by screwing, welding, flanges, or flexible joints, etc., joints between copper piping shall be by means of copper-alloy unions. Care shall be taken to ensure that all piping and fittings are clean internally and free from particles of sand, soil metal fittings and chips, etc.

7.3 Manholes
Supply and install all manholes where shown on the approved drawings. All manholes shall be of reinforced concrete and provided with cast iron manhole cover and frame. All manhole covers shall be of double seal and conforming to BS EN 124 or equal for heavy, medium or light weight duty usages, as directed by FEWA/Engineer.

7.4 Booster Water Pumps
Pumps shall conform to the following requirements unless otherwise specified:

- a) Floor mounted pumps shall be provided with at least 100 mm high concrete base with 12 mm reinforcing bars at 200 mm centres each way dowelled into the concrete floor.
- b) Piping shall be supported from the building structure so as to prevent any strain on the pump casing.
- c) Pumps shall be of the Centrifugal type with non-over loading characteristic and shall not overload the motor above its horsepower rating under any operating conditions with ratings based on continuous operation. Any motor horsepower shown is the estimated minimum requirement and larger motors shall be furnished if necessary to meet the non-overloading requirements.
d) The Contractor shall submit for approval a complete descriptive information covering the pumps and motors, their efficiencies, construction, etc. and these will be taken into consideration when determining the acceptability of the pumps proposed.

e) Pumps and motors shall be of two multistage horizontal stainless steel construction centrifugal type (one duty and one standby) and shall be non-self priming type coupled with electric motor 1.25 HP - 1 times 240 V and 50 Hz 2900 RPM. The booster set is complete with gate valves on suction and discharge of each pump, non return valves on discharge of each pump, interconnecting pipe work, pressure switch, pressure gauge, 60 liter pressure vessel, automatic control panel and suction/discharge manifolds all assembled on a common base with anti-vibration mounting and GI manifolds.

f) Pumps shall be provided with starters and wiring for connection. Wiring and connections from starters to nearest board shall be provided for under the Electrical Installations.

7.5 Water Tank

Water storage tanks shall be supplied, erected and connected in the position indicated on the approved drawing and in accordance with the details provided. The tank shall be under a shade. The tank shall be of the size and capacity indicated on the drawing. The capacity shall be without free board unless specifically indicated otherwise. The tank shall be made of insulated GRP panels to suit the dimensions and capacity indicated.

- The tank shall include the following:
  a) Mains cold water inlet to tank complete with ball valve as indicated elsewhere, and fullway gate pattern isolating valve.
  b) Cold Water down feed connection complete with fullway gate pattern isolating valve for parent service.
  c) Overflow connection.
  d) Drain connection complete with bronze gate valve having wheel handle, non-rising stem, screwed bonnet, solid wedge type manufactured in accordance with BS 19-2 arranged to drain from the bottom of the tank.

All tank connections shall be full bore of the sizes indicated on the drawings. The outlet from the drain valve shall be run to the position indicated on the drawing. All tank overflows shall be run to the position indicated on the drawing. The tank shall be provided with a lightweight dust lid complete with easily removable 300 mm min. square flanged and bolted on access cover positioned directly above the ball valve, and complete with mushroom cowed ventilator. The tank shall be supported on RSJ's not less than 75 mm wide at 610 mm centres in one direction only and in accordance with the manufacturer's requirements. On completion of installation the tank shall be filled and tested for a minimum period of 2 hours. For a satisfactory test all joints shall remain watertight, no leaks shall be detected, and no visible bulging of the tank walls shall occur. Should the test not prove satisfactory, all defects shall be repaired and the tank re-tested at no cost to the contract.

7.6 Placing of Sanitary Fixtures

When equipment and fixtures are installed, the Contractor shall install such types of fixing devices as are required to provide for the convenient removal of the equipment and fixtures. The Contractor shall submit leaflets or catalogues to determine design and shape of accessories, such as sanitary equipment, valves, etc. Lavatory brackets, cisterns, etc., shall be sufficiently fixed to the walls, if deemed necessary by the Engineer, by bolts going through the wall. All necessary electrical parts shall be of a type to suit the local conditions and shall be in compliance with the relevant standards, for electrical equipment and shall comply with the manufacturer's instructions in respect of installation.
7.7 Earthing of Metal Parts
The Contractor shall ensure electrical continuity of all pipeline networks, as installed by him and to which all other metal parts of the installation have to be connected.

7.8 Ceramic Fixtures
All ceramic fixtures shall be of best quality, regular selection, porcelain thoroughly fused, producing a white material which, when fractured, shall show a homogenous mass with close grain and free from pores. All surfaces coming in contact with walls, floors, or surfaces or other fixtures shall be reasonably flat.

7.9 General Requirements for Fixtures
- All fixtures shall have the manufacturer’s label or trade mark indicating first quality.
- All fixtures requiring hot and cold water shall have the cold water tap on the right hand side of the fixture and the hot water on the left side of the fixture.
- All fixtures shall be of the same manufacture, unless otherwise directed by the Engineer.
- All plumbing fixtures installation shall be in accordance with manufacturer’s printed instructions for conditions indicated and as required to obtain a rigid installation. The location of each fixture and the fixing method of ceramic fixtures shall be as shown on the drawings.
- The Contractor shall be responsible for protecting against injury from building materials, acids, tools and equipment, all plumbing fixtures included in these Specifications.
- After all fixtures have been mounted and are ready for use and before leaving the job, the Contractor shall thoroughly clean all fixtures furnished and mounted under this Contract, removing all plaster, stickers, rust stains and other foreign matter or discolorations of fixtures, leaving every part in perfect condition and ready for use.
- Any accessories for fixtures of steel must be supplied, adequately protected against corrosion.

7.10 Fixtures

7.10.1 W.C. Set
Complete flush type, floor-mounted, porcelain with plastic seat, low-hanging porcelain flush tank, connection elbow, angle stop, paper holder and coat hook and closet-brush set. Floor mounted water closets shall be approx. 35 cm by 60 cm in size, siphonic closet type, having an “S” or “P” trap with 3” or more outlet, 15 litre capacity low level porcelain flushing cistern fixed to the wall with cantilever brackets or concealed fixing 1-1/2” diameter flush pipe, non-corroding valveless siphon 1/2” low pressure ball valve and union, 1/2” overflow and union, flush valve for low level cistern and with double flap solid section plastic seat, toilet paper holder. All visible metal parts shall be chromium-plated. Tap with hose connections to be provided at a suitable water draw-off point adjacent to the water closet.

7.10.2 Wash Basins
The washbasin shall be approximately of size 26 cm by 40 cm. Fittings three-hole lavatory fittings 1/2” with fixed cast spout projection 125 mm with pull-knob pop-up waste 1-1/4”. Supply and install wash basins wherever shown on the drawings. Each shall be white coloured vitreous china complete with its pedestal.
- The lavatory shall be furnished with the following:
  - Wall supports.
  - Wash hand basin mixer and tap unit.
  - Chrome plated bottle trap with wall flange.
- Vitreous china shelf 560 mm of the same colour as the fixture.
- Vitreous china soap holder.
- Chrome plated angle valves for hot and cold water supply complete with copper tube 300 mm. and handle.

7.10.3 Storage Water Heaters
Unless otherwise mentioned capacity of minimum, 50 litres for toilet and 100 litres for kitchen for providing permanent hot water at any time. Inside container made of tinned copper as pressure level, with all fittings, high grade heat insulation thermostat control adjustable to any temperature exchangeable heating flange, safety cut-out slim sheet outer casing with lacquer finish, including safety valve. Complete in every respect, connected to all fixtures including all wiring work.

7.10.4 Electrical Hand Dryer
Hygienic hand dryer, which operates automatically when hands are held underneath it, and switches off when hands are removed. Heater loading 1.65 kW. Necessary electrical connections shall be included.

7.10.5 Regular Floor Drains
All wet rooms shall have floor drains of tar coated cast iron with stench trap for direct connection to the drain system. The trap shall be covered with grating made of stainless steel 18-8, size 15/15 cm. Floor drains shall have outlets of DN 70 or DN 100.

7.10.6 Washroom Accessories
This work shall include the supply and installation of washroom accessories, like mirrors, coat hooks, grab bars, towel rails, standing showers, tray, curtains and shower rods, soap dishes, toilet roll holders, etc.

- **Coat Hooks**- Fabricated of stainless steel with satin finish. Flange shall be equipped with concealed 1.5 mm mounting bracket, which locks to concealed stainless steel wall plate with stainless steel set screw.

- **Water Taps, Soap Tray and Towel Rail**- Water taps shall be chromium-plated red brass and connected to 1/2” pipes. Taps shall be equipped with threaded hose connection. Chromed soap tray. Chromed towel rail.

- **Mirrors**- Mirror shall be framed with one piece satin finish stainless steel angle (19 mm x 19 mm) welded corners. Provide mirrors, with 1 mm galvanized steel back with formed edges for additional strength, equipped with integral horizontal hanging brackets secured with concealed head locking screws. Back of mirror shall be protected by shock-absorbing waterproof, non-abrasive 6 mm thick polystyrene padding. Float glass of 4 mm min. mirror shall be guaranteed for minimum 10 years against silver spoilage and be protected on edges by high impact plastic filler strips.

- **Grab Bars**- Provide grab bars with non-slip gripping surface and satin finish flange and grab bar. Provide fastening kits for each type of wall constructed.

- **Execution**- Install washroom accessories in accordance with manufacturer’s instructions, and as specified herein. Securely fasten accessories, level and plumb, where fasteners are exposed, use tamper-proof fasteners finished to match items secured. Install washroom accessories where indicated on drawing or where directed by FEWA/Engineer. Do not install any items until approval of location is given by FEWA/Engineer. Use manufacturer’s recommended anchoring systems. Fit flanges of accessories snug to
wall surfaces. Caulk gaps between return flanges and finish wall surfaces after accessories are installed with clear silicone sealant. Upon completion of the work or when directed, remove all traces of protective coatings or paper. Test mechanisms, hinges, locks and latches and where necessary, adjust and lubricate and ensure that washroom accessories are in perfect working order.

7.11 Painting of Plumbing Works

7.11.1 General
Surfaces requiring prime painting, shall be cleaned thoroughly of all rust, loose scale, oil, grease and dirt. Wire brushes and solution shall be used for this purpose. No painting shall be done on damp surfaces. Shop coated surfaces shall be cleaned thoroughly and retouched where necessary. Paint shall be evenly spread and well brushed out so that there shall be no drops, runs or sagging. Care shall be taken not to paint controls, label plates and name plates.

7.11.2 Piping
All metallic piping in trench, partitions, below tiles, or underground, shall receive 2 coats of red lead primer and then be wrapped with one layer of self adhesive PVC tape, specifically made for pipe protection. All exposed pipes, fittings, unions, flanges, valves, hangers and supports shall receive 2 coats of red lead primer and 2 coats of finished paint. All insulated metal surfaces exposed to view shall receive 2 coats of base paint before the application of the insulation and 2 coats of finishing paint over the insulation, if the insulation is exposed to view.

7.12 Tests

7.12.1 Testing of pipes
In general, pressure tests shall be applied to piping systems only, before connection of fixtures, equipment and appliances. All defective works shall be promptly repaired or replaced and the tests shall be repeated until the particular system, and component parts thereof, receive the approval of FEWA/Engineer. When pipes, valves, equipment etc., are to be covered or imbedded or insulated, their specific tests shall be carried out on them before any covering is applied.

All piping systems, including valves, fittings and joints shall be tested under a hydrostatic pressure equal to at least 1.5 times the specified working pressure, unless instructed otherwise by FEWA/Engineer.

All elements such as traps, instruments, automatic valves, diaphragm valve, relief valves, pumps or any other equipment which may be damaged by test pressure shall be blanked off or removed. All valves shall be open but not back seated.

The system shall be filled with water and vented at high points to remove air. The required test pressure shall be maintained for a minimum of twenty four hours, for all joints and connections, unless specified otherwise.
B. KITCHEN EQUIPMENTS

1. **General:**

The work under this specification comprises the supply and installation of the complete kitchen equipment. It shall be in accordance with the Technical specification and shall include the following:

- Factory manufactured timber kitchen cabinets.
- Floor unit with stainless steel sink and wall units.
- Hot/cold water supply.
- One water cooler, free standing capacity about 3 gallons/hour.
- One refuse basket – large.
- One electric kettle
- One porcelain tea set for 6 persons
- One refrigerator of 160 litres capacity

The contractor shall, prior to the commencement of the work, prepare and submit to the Engineer detailed drawings indicating the layout of the kitchen facilities, with a complete description of the various pieces of equipment included in his delivery.

Moreover, all materials and components to be supplied erected or installed by the contractor shall be new, unused and from approved reputable manufacturers. All manufactured items shall likewise be commercial products off reputable manufacturers.