

# **TECHNICAL SPECIFICATIONS**

## **PLUMBING**

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## **PART 1 – GENERAL REQUIREMENT**

### **1.01 SUMMARY**

- A. The General Conditions apply to all work under this section of the Specifications.

### **1.02 SCOPE OF WORK:**

- A. Unless otherwise specified, the Contractor or his sub-contractor shall furnish all materials, tools, equipment, apparatus, appliances, accessories, transportation, labor and supervision required for the complete installation and testing of the Plumbing System ready for use in accordance with the best practice of the Plumbing Trade as listed herein but not limited to the following:
  - a. The Plumbing Contractor is required to refer to all architectural, structural, mechanical, fire protection, electrical and interior designs plus landscape plans and investigate all possible interference and conditions affecting his work.
  - b. All work shall comply with the pertinent provisions of the National Building Code of the Philippines, the Code on Sanitation of the Philippines, the Uniform Plumbing Code of the Philippines, the National Plumbing Code of the Philippines, the International Plumbing Code, NFPA, ASHRAE, ASPE and/or the Local Ordinances of the concerned city.
  - c. Tapping from an existing public water main of the site distribution to include supply & installation of main water meter and sub-water meters.
  - d. Water supply and distribution system for the building and ground, including supply and installation of water tank and accessories and pump piping.
  - e. Sanitary drainage including soil drainage, waste drainage, aircon drainage and vent system, within the building.
  - f. Sewage collection and private disposal system including building sanitary sewer, sanitary sewer junction boxes to proposed private sewage disposal system.
  - g. Building storm drainage system including deck and gutter drains, canopy drains, plant boxes drains and building area drains.
  - h. Site drainage system including parking drains, trench drains, storm sewer junction boxes, and storm drainage manholes up to the tapping point to the existing storm sewer system.
  - i. Installation of owner's supplied plumbing fixtures, fittings, trims and accessories.
  - j. Testing for leakage of all water supply and distribution system, AC drains, soil, waste and vent system plus pressure testing and disinfections of the water supply and distribution system.

- k. Testing for leakage and disinfections of all water tanks.
- l. Supply and installation, test run and start-up of equipments, transfer pumps, booster pumping systems, sump pumps, sewage pumps, dewatering pumps and other equipments under Plumbing/Sanitary Works.
- m. Securing of all permits and licenses as required including water connection.
- n. Excavation and backfilling in connection with the work shall be included.
- o. Preparation and submittal of two (2) sets of as-built plans.
- p. Furnishing of written, one (1) year warranty on the plumbing system.

#### **1.03 WORK NOT INCLUDED**

- A. Construction of oil interceptor tank shall be by Civil Works.
- B. All electrical power wirings, except that furnished as an integral part of factory assembled equipment except as otherwise specified herein.
- C. Painting except as required by the Plumbing Code and as specified herein.

#### **1.04 NOTES ON DRAWINGS:**

- A. The Drawings show the general arrangement all piping. However, where local and/or actual conditions at the jobsite necessitate a deviation or rearrangement; the Contractor shall prepare and submit the new arrangement for the Engineer's approval.
- B. Small scale Drawings do not possibly indicate all offsets, fittings and other parts of the system required. The Contractor shall arrange such work accordingly, furnishing such fittings, traps valves and accessories as may be required to meet such conditions.

#### **1.05 APPLICABLE SPECIFICATION, CODES, ORDINANCES, PERMITS & FEES**

- A. The work covered in this contract is to be installed according to the specs, codes, ordinances and requirements of the following:
  - 1. National Plumbing Code of the Philippines
  - 2. Uniform Plumbing Code of the Philippines
  - 3. International Plumbing Code
  - 4. National Building Code of the Philippines
  - 5. NFPA 101 – Life Safety
  - 6. The Code on Sanitation of the Philippines
  - 7. Dept. of Environment & Natural Resources

8. Ordinances of concerned city or municipality
  9. Philippine Society of Sanitary Engineers Manuals
  10. American Society of Plumbing Engineers Manuals
  11. American Society of Sanitary Engineers Manuals
- B. All construction permits and fees required for the work shall be obtained by and at the expense of the contractor. The contractor shall furnish the Owner final certificates of inspection after the completion of the work.

**1.06 WORKMANSHIP & COORDINATION WITH TRADES:**

- A. All works shall be performed in first class and neat workmanship by mechanics skilled in their trades and such mechanics and their work shall be satisfactory to the Engineer.
- B. The Plumbing Contractor is required to refer to the General Conditions and to all architectural, structural, electrical, mechanical and fire protection plans and specifications and shall investigate all possible interferences and conditions affecting his work.

**\*\*END OF SECTION\*\***

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. Except as specified, the Contractor shall submit for the Engineer's approval, four (4) copies of a complete list of manufacturer's names of all equipment and materials he proposes to use, within thirty (30) days after award of contract.
- B. The Contractor shall assume the cost of and the entire responsibility for any change in the work as shown on contract drawings, which may be occasioned by approval of materials other than, those specified.

### **2.02 PIPES AND FITTINGS SCHEDULE**

- A. **Potable Water Lines** – from tapping point to water meter to tank and pump assemblies and risers and down-feeds shall be galvanized steel iron (G.I.) pipe, schedule 40, conforming to ASTM A 53 - Grade A, ASTM A-120-80, shall be malleable iron, class 150. Jointing shall be screwed connection. Provide corrosion protection, coated with petroleum based paste and wrapped with petrolatum .

For risers, down feeds, distribution line & roughing- in of toilets shall be polypropylene-random pipes & fittings , PN 20, conforming to ASTM F - 2389-15, ASTM D 1238, ASTM D 1505. Jointing shall be by socket fusion for pipes while for the fitting connection with metal inserts leak proof of swallowed tail structure type firmly united between plastic and metal under temperature changes.

- B. **Soil, Waste Lines and Vent System** – shall be high density polyethylene (HDPE) pipes and fittings conforming to SDR 26 PN5

- C. **FCU/AHU/AC Drain lines** – shall be polyvinyl chloride (PVC) pipes and fittings, series 1000 II for 50 mm dia and above

For 40 mm. dia and below shall be PVC Blue. Jointing shall be solvent cement jointing conforming to ASTM D2564. Provide fiberglass insulation. All should be covered with an approved insulation material.  
Refer mechanical specifications.

- D. **Storm Leaders (Downspouts) and Storm Drainage Collector** – shall be high density polyethylene (HDPE) pipes and fittings conforming to SDR 26 PN5

## 2.03 VALVES

- A. **Gate valve** - 65 mm. dia. & larger, shall be rising stem, iron body with bronze trim, flanged connection, min. of 150 psig working pressure. 50 mm. dia. & smaller, shall be rising stem, all bronze, female threaded, min. of 150 psig working connection.
- B. **Check Valve** - for booster pumps, 65 mm. dia. & larger shall be iron body with bronze trim, flanged connection, min. of 150 psig working pressure. 50 mm. dia. & smaller, same except female threaded connection.
- C. **Float Valve** - shall be hydraulically operated, diaphragm actuated valve with the pilot control and float mechanism mounted on the cover of the main valve. The float positions the pilot control to close the valves when float contacts the upper stop and to open the valve when the float contacts the lower stop.
- D. **Pressure Reducing & Pressure Sustaining Valve** - shall be double chambered, hydraulically operated pilot controlled, diaphragm type globe valve. The control system shall consist of a reducing control sensitive to diaphragm pressure changes and pressure sustaining control that is sensed to the main valve inlet.
- E. **Pressure Relief Valve** - shall be a diaphragm type valve to maintain constants upstream pressure to close limits. The valve shall be hydraulically-operated, pilot controlled modulating type, main body at cover to Cast Iron ASTM-A1 with adjustment ranges, 20 to 200 PSIG.

## 2.04 OTHER MATERIALS

- A. **Drains**
  - 1. Roof / Gutter
  - 2. Floor/ Shower
  - 3. Deck
  - 4. Area Drain
  - 5. Floor cleanout
  - 6. Planters Drain
  - 7. Trench Drain
  - 8. Scupper Drain
  - 9. Gutter Drain
  - 10. Parking Drains
- B. **Water Meter** - approved by the local water service provider.
- C. **Hose Bibbs** - 20 mm. dia. standard hose connection, male tapered threads, polished chromium plated..
- D. **Outdoor Pipe Lines, Appurtenances:**

1. **Drainage Junction Boxes** - 140 kg/sq. c. m. reinforced concrete with pre-cast reinforced concrete cover.
2. **Thrust Blocks** - 140 kg/sq. c. m. plain concrete
3. **Sewer Junction Boxes** - 140 kg/sq. c. m. reinforced concrete with C.I. grating cover.
4. **Area-Drain/Catch Basin** - 140 kg/sq. reinforced concrete with C.I. grating cover.

## 2.05 JOINTING

- A. **Flanged Joint Gasket**
- B. **Screwed Joints** - U.S. Federal Specifications GG-P-251.
- C. **PVC Pipes and Fittings** - PVC cement or as per the Manufacturer's recommendations.
- D. **Polyethylene/Polypropylene** - pipes and brass fittings or by fusion welding.
- E. **Hubless Cast Iron Soil Pipes** - sleeve type coupling & gasket for hubless pipes, conforming to ASTM Standard C-26.
- F. **Centrifugal Gray cast Iron** – Bell and Spigot, gasketed sliptite joint
- G. **Dissimilar Pipes** – Adaptor fittings shall be used.
- H. **Concrete Drain Pipe** – Cement mortar

**\*\*END OF SECTION\*\***

## **PART 3 - IDENTIFICATION & APPROVAL OF MATERIALS**

### **3.01 GENERAL**

- A. Each length of pipe, fittings, traps, fixtures, and device used in the Plumbing System shall have cast, tamped or marked on it, the manufacturer's trade mark or name, weight, type and classes of product when so required by the Standard.
- B. Within thirty (30) days after award of the Contract, the Contractor shall submit for the Engineer's approval, the names of suppliers and materials proposed including trade names and/or samples of the materials if deemed necessary.
- C. Brand names mentioned in this Specification are only for the purposes of indicating the desired quality and design.

**\*\*END OF SECTION\*\***

## **PART 4 - SUBSTITUTION & TESTING OF MATERIALS**

#### 4.01 GENERAL

- A. Materials intended to be substituted from those originally specified shall be accepted only after a formal request for substitution, accompanied by:
  - 1. Reasons for substitutions;
  - 2. Certificate of test indicating quality, compared to those originally specified.
  - 3. Cost comparisons with material originally specified. Requests shall be submitted to the Engineer for evaluation at least 15 working days before installation of subject material is due, or at least 7 days before opening of bids.
- B. Cost of testing of materials, whether on originally specified items or on substitution, shall be to the account of the Contractor.
- C. Results of tests shall be submitted to the Engineer for evaluation at least 15 days before the material is due for installation on the job.

**\*\*END OF SECTION\*\***

## **PART 5 - SOIL, WASTE, AND VENT PIPES**

## 5.01 GENERAL

- A. Soil, waste and vent pipes and fittings shall be as stated under Part 2 of this Specification.
- B. All sewer and drainage pipes shall be pitched 6mm per 300mm for pipe size 75mm dia. and smaller but in no case flatter than 3mm. per 300mm for pipe size 100mm dia. and higher.

## 5.02 SUPPORTS

- A. Horizontal lines shall be supported by well secured length heavy-duty strap hangers or floor chairs as required. Hooks to the building frame shall secure vertical lines strongly and a suitable bracket or chairs shall be provided at the floors from which they start.
- B. Soil pipes in trenches under the ground shall be laid through the line and grade on a stable and suitably prepared foundation, each section of the pipe being properly bedded.
- C. In soft ground liable to settlement, a gravel base 300mm. deep and twice the width of the pipe shall be rolled or tamped. Backfilling shall be carefully placed and tamped for the purpose, in such a manner that the pipe lines or connections are not disturbed.

## 5.03 TRAPS

- A. Every plumbing fixture shall be separately trapped by a vented water sealed trap as close to the fixture outlets as the conditions allow, but in no case at a distance greater than 600 mm. In case of the upper or the only fixture on a soil pipe extended full size through the roof, a vent shall not be required when said fixture has its center stack. Traps shall be of the same diameter as the waste pipes from the fixtures that they shall serve, all traps shall have a water seal of at least 32 mm. with a brass thumbscrew cleanout at the bottom of the seal.

## 5.04 VENTS

- A. Vent shall be taken from the crown of the fixtures, except for water closet traps, in which case, the branch line shall be vented below and trap and above all small waste inlets, so connected as to prevent obstructions. Each vent pipe shall be run separately above the fixtures into the adjacent soil pipes, a distance not more than 1.50 meters. If more than this distance, the vent shall run independently through the roof.
- B. A vent line shall be wherever practicable, direct extension of a soil or waste line.
- C. Main vent risers at 4.5 meters along or more shall be connected at the foot with the main waste or soil pipes below the lowest vent outlet with a forty-five degree (45) connection.

- D. All vertical soil or vent pipes shall be carried up at least 600 mm above the roof of the building and the open side ends are to be entirely and securely covered with ga.16 mesh copper cloth.
- E. Vent pipes in roof spaces shall be run as close as possible to the underside of roof with horizontal piping pitched down to stacks without forming traps. Where an end or circuit vent pipes from fixtures it shall be connected into the main vent or vent stack.

#### **5.05 ROUGHING - IN**

- A. Roughing - in for pipes and fixtures shall be carried along with the building construction. Correctly located openings of proper sizes shall be provided where required in the walls and floors for the passage of pipes all items to be embedded in concrete shall be thoroughly clean and free from all rust, scale and paint.

#### **5.06 FITTINGS**

- A. All changes in pipes sizes on soil, waste and storm lines shall be made with reducing fittings or reducers. All changes in direction shall be made by the appropriated use of forty-five degrees (45) wyes, or long sweep bends, except that sanitary toes may be used on vertical stacks. Short quarter bends or elbows may be used in soil and waste lines where the change in direction is from the horizontal to the vertical and on the discharge from the water closet.

#### **5.07 JOINTS AND CONNECTIONS**

- A. All joints shall be air and watertight. For joining pipes, the following shall be used:
  - 1. Cast iron soil and waste pipes & fittings, hubless sleeve type joints.
  - 2. Centrifugal gray cast iron – Bell and spigot, gasketed sliptite joint
  - 3. Cast iron - Bell and spigot, lead and oakum
  - 4. Galvanized wrought iron or steel piped; screwed or threaded joint; use sealant.
  - 5. Lead to cast iron pipes; Adaptor fittings, screwed and hubless coupling gasket joints.
  - 6. Concrete pipes; bell and spigot or tongue and groove.
  - 7. Polyvinyl chloride (PVC) pipes, socket type with PVC cement.
  - 8. Polyethylene/Polypropylene pipes, brass fittings and electro fusion or socket fusion joints.
  - 9. Epoxy shall not be allowed.

**\*\*END OF SECTION\*\***

## **PART 6 - WATER DISTRIBUTION SYSTEM**

### **6.01 METER**

- A. Water meters shall be furnished by the Contractor and installed with the proper and complete piping arrangements for the system.
- B. The exact dimensions for setting the meter shall be as per requirements of the local water service provider.

### **6.02 INSTALLATION**

- A. The piping shall be extended to all fixtures, outlets and equipment from the gate valves installed in the branch near the riser.
- B. Unions shall be provided where required for disconnection.
- C. All pipes shall be cut accurately to measurements and shall be worked into place without springing or facing. Care shall be taken so as not to weaken the structural portions of the building.
- D. All service pipes valves and fittings shall be kept at sufficient distance from work to permit finished covering not less than 15 mm from such work or from finished covering on the different service.
- E. Changes in pipes shall be made with reducing fittings.
- F. Accessible Contraction - Expansion joints shall be made wherein necessary. Horizontal runs of pipe over 15 m. in length shall be anchored to wall or the supporting structure about midway on the run to force expansion and contraction equally towards the ends.

**\*\*END OF SECTION\*\***

## **PART 7 - EXCAVATING, PIPE LAYING AND BACKFILLING**

### **7.01 TRENCHES**

- A. Trenches for all underground pipelines shall be excavated to the required depths and grades. Bell holes shall be provided so that pipe will rest on well-tamped solid ground for its entire length. Where rock is encountered, excavation shall extend to a depth 150 mm below the pipe bottom and other approved filling materials.

### **7.02 CONCRETE PROTECTION**

- A. All pipes except concrete pipes and cast iron soil pipes that will run underground shall be protected with Class B concrete casing, a minimum of 100 mm around the pipe perimeter and 300 mm below the finish grade.

### **7.03 MATERIALS**

- A. Materials for backfilling shall be free of debris or big rocks. Backfill shall be placed in horizontal layers, properly moistened and compacted to an optimum density that will prevent excessive settlement and shrinkage.

**\*\*END OF SECTION\*\***

## **PART 8 - MISCELLANEOUS**

### **8.01 CLEANOUTS**

- A. Cleanout shall be of the same size as the pipe, the location of which is extended to an easily accessible place.

### **8.02 TRAPS**

- A. Every plumbing fixture of equipment requiring connections to the drainage system shall be equipped with a trap.
- B. Each trap shall be placed as near as possible to the fixture. No fixture shall be double trapped.

### **8.03 VALVES AND HOSE BIBBS**

- A. Valves shall be provided on all water supplies to fixtures as specified.
- B. Hose bibbs shall be made of brass with 15 mm. dia. male inlet threads hexagon shoulders and 20 mm. dia. connections.

### **8.04 PIPE HANGERS INSERTS AND SUPPORTS**

- A. Horizontal runs of pipe shall be hung with adjustable wrought iron or malleable iron pipe hangers spaced not over 3m. apart. For PPR pipes DN 25mm diameter and smaller to be supported 900mm apart while over DN 32mm diameter shall be 1.2m apart, except hub and spigot cast iron soil pipes which shall have hangers spaced not over 1.5m apart and located near the hub, while for plastic pipes to be supported 1.2m apart..
- B. Hangers shall have short turnbuckles or other approved means of adjustment.
- C. Inserts shall be of cast steel and shall be of type to receive a machine bolt or nut after installation.
- D. Wrought iron clamps shall be use to support vertical pipe runs or collars spaced not more than 9 m. apart.
- E. Water and Vent Pipes - 65 mm. dia. and larger; band type 6.1 mm x 25 mm flat mild steel or black iron with 15 mm. dia. round rod with plates and nuts; 50 mm. dia. and smaller split ring type with 10 mm. dia. iron rods with inserts plates; toggle bolts, clamps or expansion shield.

### **8.05 PIPE SLEEVES**

- A. Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through masonry or concrete.
- B. Pipe sleeves shall be of sufficient diameter to provide approximately 6.1 mm clearance around the pipe of insulation.

- C. Pipe sleeves in walls and partitions shall be of cast iron, wrought iron or steel pipe. Pipe sleeves in concrete beams or concrete slabs shall be wrought iron or steel pipe. Pipe sleeves in concrete beams or concrete slabs shall be wrought iron or steel pipe.
- D. Pipe sleeves on footings shall be cast iron or steel and shall be not less than 100 mm. dia. larger in diameter than the pipe to be installed.
- E. Where pipes pass through waterproofing membrane, the sleeves shall be provided with an integral flange or clamping device to which a flashing shield can be soldered.
- F. The space between the pipes and sleeves shall be made watertight by inserting a packed oakum gasket and filling the remaining space with poured lead caulking thoroughly.
- G. All penetration through the fire wall and floor shall be properly sealed with the approved fire rated sealant complied to Engineer's requirement. "HILTI", "SPECSEAL" or approved equal.

**\*\*END OF SECTION\*\***

## **PART 9 - FIXTURES, FITTINGS, AND ACCESSORIES**

### **9.01 GENERAL**

- A. Verify Architect's and Engineer's specification

**\*\*END OF SECTION\*\***

## **PART 10 - PUMPS**

### **10.01 GENERAL**

- A. All requirements shall be supplied from reputable firms engaged in the manufacture of each particular item. The entire assembly as installed shall be given a start-up and test run to prove that all the specifications have been met before acceptance by the Owner. The test duration shall be 24 hours. Submittal of the Certificate of Test to the Owner's shall be a condition of final payment.
- B. The Specification herein stated are basic guide only. Other items not so indicated but which are obviously necessary for the proper operation of system as intended shall be supplied in accordance with accepted engineering standards.
- C. The equipment shall be guaranteed for a period of at least one (1) year of trouble free operation. The supplier of equipment shall certify to the availability of spare parts locally and service in case of system breakdowns within a period of at least three (3) years. Manuals of operation and maintenance and lists of spare parts shall be supplied together with the equipment. Submittal of Warranty Certificate shall be on condition to the final payment.
- D. The supplier shall submit at least two (2) copies of pumps performance curves showing among others, the pump rating and pump efficiency, properly marked thereon.
- E. Accessories to be supplied for each group shall include one non-slam type check valve, two (2) gate valves, approved type of strainer, 2 flexible connection; of size equal to the size of pump discharge and suction and rated 150 psi. Also, one pressure gauge for each set of pumps and pipe fittings necessary for complete installation shall be provided. The pressure gauge shall be 100 mm. face diameter and shall be reading from 0 psi (or kg/cm) to 100 psi (or 7kg/cm).
- F. Price quoted shall include cost delivery of all quoted items to the jobsite. Pump and motor installation dimension drawings shall be submitted together with the quotation.
- G. The brands, names, and place of manufacture of pump, motor, valves, controls and all accessories where applicable shall be indicated in the quotation. Also, a description of pump impellers being offered shall be included.
- H. A metal nameplate indicating in indelible letters the correct specifications of the pump and motor shall be properly attached to the assembly at a location such that the information written thereon can be conveniently read by all concerned.
- I. A separate price shall be quoted for installation work and preparation submittal of as installed drawings.

**10.02 CONSTANT PRESSURE SYSTEM**

- A. Verify equipment schedule and approved buying specifications

**10.03 TRANSFER PUMPS**

- A. Verify equipment schedule and approved buying specifications

**10.04 BOOSTER PUMPS**

- A. Verify equipment schedule and approved buying specifications

**10.05 SUBMERSIBLE PUMPS**

- A. Verify equipment scheduel and approved buying specification

**\*\*END OF SECTION\*\***

## **PART 11 - WATER RESERVOIR**

### **11.01 UNDERGROUND CISTERN TANKS**

- A. Underground cistern tank shall be reinforced concrete. Refer to Structural specifications and Architectural for water proofing specifications.

### **11.02 OVERHEAD WATER TANK**

- A. Overhead water tanks shall be Glass Reinforced Panel (GRP). Refer to manufacturer's specifications.

### **11.03 RAINWATER TANK**

Rainwater tanks shall be reinforced concrete embedded underground. Refer to Structural specifications and Architectural for water proofing specifications.

### **11.04 PIPING, FITTINGS AND MISCELLANEOUS METAL WORKS**

- A. Furnish and install all pipe fittings, valves, specials, pipe supports, miscellaneous metal work and all required appurtenances as shown on the plans and as required to make the entire piping system operable.
- B. All materials furnished and installed shall be new and guaranteed free from defect in design, materials and workmanship.
- C. Adequate protective measures shall be provided to protect pipes, fittings, valves and all other materials from damage or injury during storage and installation.

### **11.05 FLANGES, GASKETS, AND BOLTS**

- A. Flanges shall conform in dimensions and drilling to ASA B-16.1 Class 125.
- B. Gaskets shall be ring-type.
- C. Bolts shall be standard square head machine bolts with heavy, hot, pressed hexagon nuts. Threads shall conform to ASA B-1.1, coarse thread series, Class 2 fit.

### **11.06 LADDER RUNGS**

- A. Ladder Rungs shall be of 20 mm. diameter round stainless steel bar.

### **11.07 INSTALLATION**

- A. All pipes shall be carefully placed and supported at the proper lines and grade where possible shall be sloped to permit complete draining.
- B. Piping runs shown on Drawings shall be followed as closely as possible, except for minor adjustments to avoid adverse-effect on architectural and / or structural features. If major relocations are required, they shall be subjected to the approval of the Engineer.

- C. Carefully inspect all pipe and fittings before installation. Inspection of pipe shall include light tapping with a hammer to detect cracks or defects. No pipe fittings or valve which is cracked or shown defects shall be used.
- D. Suitable anchors, brackets, or hangers shall be provided to all piping. Vertical pipes shall be anchored by suitable galvanized steel straps. Pipe supports shall be provided as shown on the plans and whenever else necessary to prevent stain on joints or to facilitate taking down pipe.
- E. Piping through the Walls - Where the pipe pass through walls, care shall be exercised to insure this joint are watertight.

#### 11.08 TESTS FOR WATER

- A. **Tightness of Completed Tank** - The completed underground cistern, overhead water and rainwater tank shall be tested for water-tightness by filling it up with clean water after cleaning out all dirt and debris inside the tank. The water shall be allowed to stand for a minimum period of 24 hours reckoned from the time the free-board line was reached during filling up. After the 24 hour period there shall be no drop in water level in the tank more than 40 mm, otherwise, the leaks shall be located and plugged properly and the test for water-tightness be repeated.

#### 11.09 DEFECTIVE WORK:

- A. If the inspection and test show any defect such defective work or material shall be replaced and the test shall be repeated until such satisfactory to the Owner.
- B. All repairs shall be made with new material at the expense of the Contractor.
- C. No caulking of screwed joints or holes will be accepted.

**\*\*END OF SECTION\*\***

## **PART 12 - GREASE / SOLIDS INTERCEPTORS**

### **12.01 GENERAL**

- A. **Grease/Solids Interceptor (tenant supplied)** - Furnish and install where indicated on the drawing grease interceptors (traps) with a flow rate of 5 gpm. (min.) to serve a kitchen sink or a wet market counter.
- B. Overall efficiency of the interceptor shall not be less than 90% when operating at the specified rate of flow.
- C. Furnish and install central grease tank as required on plans. Verify drawings.

**\*\*END OF SECTION\*\***

## **PART 13 - OIL INTERCEPTORS**

### **13.01 GENERAL**

- A. Furnish and install where indicated on the Drawing an oil intercepting system, complete with oil interceptor, venting system, intake and discharge piping, test and suction line, oil storage tank and all fittings and accessories necessary for complete oil intercepting system, ready for use.
- B. The oil interceptor shall be cast iron construction with a flow rate capacity of 20 gpm. (min.). Inlet and outlet size shall be both 50 mm. (min.).

**\*\*END OF SECTION\*\***

## **PART 14 - WATER METERS**

### **14.01 GENERAL**

- A. Furnish and install where indicated on the Drawings main water meter and sub-water meters with sizes as shown on drawings.

**\*\*END OF SECTION\*\***

## **PART 15 - SITE PLUMBING UTILITIES**

### **15.01 GENERAL**

- A. The entire site plumbing utilities system shall be laid out and installed consistent throughout with the given slopes in the plans. Pipe joints and connections to area drains, catch basin, and junction boxes shall possess such leak-proof and seepage proof integrity achievable with the works called for under this particular section of the Specifications.
- B. Junction Boxes for storm & sanitary (sewer) drainage lines outside the building shall be cast-in place reinforced concrete sections and pre-cast concrete over.
- C. Trench excavation and backfilling shall be as specified in excavation, trenching and backfilling for utility system.
- D. Concrete Drainage Pipe:
  - 1. Material, Pipe shall be reinforced concrete pipe (300 mm dia. & larger) and non-reinforced concrete pipe 250 mm dia. & smaller conforming to ASTM C14-75.
  - 2. INSTALLATION:
    - a. Bedding surfaces shall provide a firm foundation, carefully shaped true to line and grade.
    - b. Concrete pipe shall be laid carefully with hubs up grade and ends fully and closely joints. Joints shall be cement mortar. Cement mortar shall consist of one part Portland Cement and 1 1/2 parts clean sharp sand with only enough water for work-ability. A gasket of closely twisted hemp or Oakum shall be placed around the pipe. The gasket shall be in one (1) piece of suitable diameter (not less than 19 mm) and shall be lapped at the top. The gasket shall be saturated with that cement before being placed and rammed. The joint shall be completely filled with cement mortar and rammed thoroughly with wooden calking tool. The joint shall then be overfilled and finished to a smooth level outside.

### **15.02 EXCAVATION FOR STORM & SANITARY (SEWER SYSTEM)**

- A. General - The Contractor shall do all excavation of whatever substances encountered below depth shown on drawings. Excavated materials not required for fill or backfill shall be removed from site as directed by the Engineer and disposed of by the Contractor. Excavation for accessories to have 300 mm minimum and 600 mm maximum clearance in all side. Excavation shall not carried below the required depth. Excess excavation below required level shall be backfilled at the Contractor's expense with earth, sand, gravel or concrete, as directed by Engineer, and thoroughly tamped unstable soil shall be removed and replaced with gravel or crushed stone, which shall be thoroughly tamped.

The Engineer shall determine the depth of removal of unstable soil. Ground adjacent to all excavation shall be graded to prevent water running. The Contractor shall remove by pumping or other means approved by the Engineer any water accumulated in excavation and keep trench from water until the bedding is complete.

- B. Trench Excavation. Banks of trenches shall be vertical. Soft materials shall be reported to the Engineer. In rock, excavation shall be carried 200 mm below bottom of pipe. Loose earth or gravel shall be used for backfill, and tamped thoroughly and rounded to received pipe as above.
- C. Rock Excavation. Rock excavation shall include removal of boulders larger than 1/2 m<sup>3</sup> in volume and ledge rock concrete or masonry structures that required drilling/melting.
- D. Bracing and Shoring. The Contractor shall do all bracing sheathing and shoring necessary to perform and protect all excavation as indicated on the plans, as required for safety, as directed by the Engineer, or to conform to governing laws.

### 15.03 TESTING

- A. Test for workmanship on utility lines shall be conducted in accordance with the applicable utility specification before backfilling.

### 15.04 BACKFILLING

- A. Backfilling: After pipes have been tested and approved, backfilling shall be done with approved material free for large clods or stones.
  - 1. Trenches. Backfilling material shall be placed evenly and carefully around and over pipe in 150 mm maximum layers. Each layer shall be thoroughly and carefully rammed until 300 mm of cover exists over pipe. The remainder of backfill material shall be placed, moistened and compacted. Water settling will not be permitted in clay soils. It may be required at the option of the Engineer in sandy soils.
  - 2. Trench under areas to be paved. Material shall be placed in 200 mm maximum layers after filling 300 mm above pipe as previously described. Each layer shall be thoroughly and compacted to density equal to that of adjacent original material so that pavement can be placed immediately.
  - 3. Structures: All forms, trash, and debris shall be removed and cleared away. Approved backfill material may come from excavation or borrow. It shall be free from rock, lumber or debris. Backfill material shall be placed symmetrically on all side in 200mm maximum layers. Each layer shall be moistened and compacted with mechanical or hand tampers. In area to be paved, each layer shall be compacted to density equal to that of adjacent materials so that pavement can be placed immediately.
- B. Maintenance. The Contractor shall refill for settlement of all backfilled areas.
- C. Clean-up. The Contractor shall clean up and dispose of all excess materials, trash, wood forms and other debris.

**\*\*END OF SECTION\*\***

## **PART 16 - TEST AND DISINFECTION**

### **16.01 DRAINAGE SYSTEM TEST**

- A. The entire drainage and venting system shall have all necessary openings which can be plugged to permit the entire system to be filled with water to the level of the highest stack vent / or vent stack above the roof.
- B. The system shall hold this water for a full three hours (180 minutes) during which time there shall be no drop of more than 100 mm.
- C. Each section of pipeline shall be slowly filled water and the specified test pressure, measured at the point of lowest elevation shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer.
- D. During the filling of the pipe in and before applying the test pressure, all air shall be expelled from the pipeline. To accomplish this, taps shall be made, if necessary, at point of highest elevation, and after completion of the test the taps shall be tightly plugged unless otherwise specified.
- E. During the test, all exposed pipes, fittings, valves, joints and couplings will be carefully examined. Defective materials shall be removed and replaced with sound materials at the Contractor's expense. The test shall be repeated until a satisfactory result has been obtained.

### **16.02 PRESSURE TESTS FOR WATER LINES**

- A. After the pipe have been installed, the joints completed and with joints exposed for examination, all newly installed pipe or any valve section therefore, shall be subjected to hydrostatic pressure  $1\frac{1}{2}$  the designed working pressure of the system or as specified by the Engineer.
- B. The duration of each pressure test shall be at least 24 hours unless otherwise specified by the Engineer.
- C. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer.
- D. During the filling of the pipe and before applying the test pressure, all air shall be expelled from the pipeline. To accomplish this type shall be made, if necessary, at point of highest elevation and after completion of the test the taps shall be tightly plugged unless otherwise specified.
- E. During the test, all exposed pipes, fittings, valves, joints and couplings will be carefully examined. Defective materials shall be removed and replaced with sound materials at the Contractor's expense. The test shall be repeated until a satisfactory result are obtained.

### 16.03 LEAKAGE TEST FOR WATER LINES

- A. Leakage test shall be conducted after satisfactory completion of the pressure and shall consist of an examination of all exposed joints for leakage as well as on overall leakage test completed pipelines.
- B. The pressure to be maintained during the test shall be the design working pressure of the system.
- C. Leakage test shall be made only after a minimum of 24 hours after the pipe to be tested have been filled with water.
- D. The duration of each leakage test shall be two hours unless otherwise specified by the Engineer.
- E. Each section to the pipeline shall be slowly filled with water at specified pressure, measured at the points of lowest elevation shall be applied by means of a positive displacement type pump and reservoir connected to the Pipeline.
- F. Before starting the leakage test, all air shall be expelled from the pipe. All expose pipes, fittings, valves and joints shall be examined for leakage during the test.
- G. Allowable leakage rate per 100 joints per inch of Pipe Diameter at Pressure.

| PRESSURE |       | LEAKAGE RATE |            |
|----------|-------|--------------|------------|
| PSI      | KG/CM | LITERS/HR.   | LITERS/HR. |
| 50       | 3.5   | 1.45         | 2.90       |
| 75       | 5.3   | 1.75         | 3.50       |
| 100      | 7.0   | 2.05         | 4.10       |
| 125      | 8.8   | 2.30         | 4.60       |
| 150      | 10.5  | 2.50         | 5.00       |
| 200      | 14.0  | 2.90         | 5.80       |

- H. No structures shall be closed until all joints have been inspected for leaks.

### 16.04 DEFECTIVE WORK

- A. If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated until satisfactory to the Engineer.
- B. All repairs to piping shall be made with new material at the expense of the contractor.
- C. No caulking of screwed joints of holes will be accepted.

**16.05 DISINFECTION OF WATER DISTRIBUTION SYSTEM AND WATER TANKS  
( as per AWWA C-601 )**

- A. The entire water system shall be thoroughly flushed and disinfected with chlorine before it is placed on operation. Water tanks shall be washed and swabbed.
- B. Chlorination materials shall be liquid chlorine or hypochlorite, as specified and shall be introduced into the water lines in manner approved by the Engineer.
- C. Tanks shall be thoroughly cleaned of all debris dirt or dust before swabbing.
- D. The chlorine dosage shall be such as to provide not less than fifty parts per million (50ppm.) or available chlorine unless otherwise specified by a Sanitary Engineer.
- E. Following a contact period of not less than sixteen (16) hours, the heavily chlorinated water shall be flushed from the system with clean water until the residual chlorine content is not greater than two tenths (0.20 ppm.). All valves in water lines being sterilized shall be opened and closed several times during the 24-hour chlorinating period.

**\*\*END OF SECTION\*\***

## **PART 17 - CLEANING**

### **17.01 GENERAL**

- A. All exposed metal surfaces shall be free of grease, dirt or other foreign materials.
- B. Chrome or nickel plated piping, fittings and trimmings shall be polished upon completion.
- C. All plumbing fixtures shall be properly protected from use and damage during the construction stage. The fixtures shall be cleaned to the satisfaction of the Engineer upon completion & prior to acceptance of work.
- D. All equipment, pipes, valves and fittings shall be cleaned of grease and sludge which may have accumulated. The Contractor shall repair any clogging, discoloration or damage to other parts of the building due to the system.

**\*\*END OF SECTION\*\***

## **PART 18 - PAINTING AND PROTECTION**

### **18.01 GENERAL**

- A. All exterior of piping to be installed in or through concrete floor or fill floors and underground shall be given one coat of acid resisting paint having a bituminous base.
- B. Pipe hanger, supports and all other iron work in concealed spaces shall be painted with one coat of asphalt.
- C. Exposed galvanized iron pipes and fittings that are 1mil asphalt coated shall be given two coats of shellac prior to application of two coats of oil paint as directed by the Engineer.

**\*\*END OF SECTION\*\***

## **PART 19 - COLOR CODE FOR EXPOSED PIPES**

### **19.01 GENERAL**

- A. All exposed piping shall be adequately and durably identified by distinctive colored paints as follows:

| <b><u>ITEM</u></b> | <b><u>COLOR CODE</u></b>           |
|--------------------|------------------------------------|
| cold water pipe    | blue                               |
| hot water pipe     | blue pipe w/ red band @ 1 m . O.C. |
| storm water pipe   | aluminum                           |
| soil pipe          | black                              |
| vent pipe          | green                              |
| waste pipe         | gray                               |

**\*\*END OF SECTION\*\***

## **PART 20 - WARRANTY & "AS-BUILT" PLANS**

### **20.01 GENERAL**

- A. All works, equipment and fixtures shall be guaranteed by the Contractor for satisfactory service for a minimum period for one (1) year.
- B. The Contractor shall submit to the Owner, in reproducible form plus three (3) sets of white prints, the complete plans of the entire system as actually built. The cost of these shall be borne by the Contractor. Submittal of "AS BUILT" Plans shall be a condition to final payment.
- B. Equipment shall have the Owner a one (1) year minimum guarantee against defective designs, materials and workmanship.
  - 1. Transfer Pumps
  - 2. Booster Pumps
  - 3. Submersible Pumps

**\*\*END OF SECTION\*\***

## **PART 21 - RESPONSIBILITIES**

### **21.01 GENERAL**

- A. The general Contractor shall be responsible for the coordination among the different trades on the job in order to finish the work in the least possible time, in strict accordance with the Plans and Specification.
1. Throughout the construction period open ends of all installed pipe lines shall be kept closed by temporary plugs.
  2. Drainage lines shall not be used to conduct dirty construction wash water especially those with cement mixes to avoid possible clogging.
  3. A temporary fire protection system shall be provided by the contractor during the construction period. This shall be of sufficient capacity to put out any fire that may break out at any floors due to construction operations. This is in addition to temporary fire extinguisher required.
  4. A temporary potable water supply shall be made available to construction workers at every floor as construction progresses.
  5. The Contractor shall provide a temporary human excreta disposal system to serve the workers during the construction period.

**\*\*END OF SECTION\*\***

