

SECTION 5

Heating System

DIVISION 15**MECHANICAL WORKS****SECTION : 5.00****HEATING SYSTEM****INDEX**

<u>CLAUSE NO.</u>	<u>TITLE</u>
5.00	General
5.01	Hot Water Heating Boiler
5.02	Pressurising Unit (Expansion Tank)
5.03	Pipework
5.04	Pipework Insulation
5.05	Valves
5.06	Strainers
5.07	Pipe Flexible Connectors
5.08	Differential Pressure Regulating Valves
5.09	Two Port Control Valves
5.10	Heating Pumps
5.11	Packaged Variable Speed Pumps
5.12	Smoke Pipes
5.13	Water Treatment
5.14	Dosing Pot
5.15	Drainage and Flushing of System

DIVISION 15**MECHANICAL WORKS****SECTION : 5.00****HEATING SYSTEM****5.00 GENERAL**

This Section of the specification covers the heating installations comprising: boilers, pumps, radiators, expansion tank and all related works as shown on the drawings and as specified herein.

5.01 HOT WATER HEATING BOILER**A. General description and Requirements**

The hot water heating boiler shall be of the fully packaged, designed and constructed in accordance with the latest ASME Code

The boiler shall be equipped with integral forced draft fuel burning equipment specifically supplied for burning No.2 light oil, boiler trim and accessories, operating and safety controls, refractory and insulation all assembled, piped and wired at the factory and delivered as a packaged unit ready for installation and operation with simple piping, power and smoke outlet connections. The complete packaged boiler shall be approved as a unit by the Underwriters' Laboratory and shall bear its label.

The completed unit shall be fire tested at the factory prior to shipment and a copy of the test report shall be furnished with the boiler.

The boiler shall be subjected to shop inspection and approval by an authorized Boiler Inspection and Insurance Co., and stamped with all identifying markings and symbols as required by the ASME Code. A certified inspection report shall be furnished with the boiler.

The boiler shall be insulated with minimum 75mm thick mineral wool blanket insulation compacted to 50 mm and covered with heavy gauge steel removable jacket with factory applied heat resisting enamel finish.

The fuel burning equipment shall be of the forced draft type and shall comprise but not necessarily limited to: flange mounted oil burner of the mechanical pressure atomizing type for No.2 light oil, direct driven blower, motor, air damper, two stage oil pump mounted on burner, oil atomizing nozzle, oil solenoid valve, oil control valve, oil supply and return pressure gauges, fuel suction strainer, ignition transformer, ignition electrodes, air flow safety switch, electronic flame sensing devices, low fire start interlock, working temperature controls, high limit temperature controls, all necessary controls and linkage for modulating firing with proved low fire start and totally enclosed electric control panel mounted on the unit at the factory.

5.01 HOT WATER HEATING BOILER (CONT'D)

The control panel shall contain an electronic programming combustion safeguard control system, magnetic motor starters with thermal overloads and low voltage release, combustion air proving switch, manual potentiometer, manual automatic selector switch, control circuit transformer, necessary switching relays, power on and burner on switches, individual fused circuits for controls, signal lights indicating ignition, flame failure and low water cutout, numbered terminal strip, color coded wiring and engraved nameplates.

Fuel air control shall provide modulating regulation of the air damper and the oil control valve by means of a modutrol motor.

The electronic programming combustion safeguard control system shall provide modulating sequence of enforced low fire start, pre purge, post purge, timed trial for ignition, proof of blower operation prior to opening of fuel valves, and positive response to shut down the burner in the event of flame failure.

The boiler manufacturer shall furnish with the boiler complete shop drawings which shall include but not necessarily be limited to: complete boiler piping and wiring diagrams with details of control panel and all controls, interlocks and setting, boiler outline drawing with dimensions, location of connections and flange ratings, complete installation, operation, servicing, care and maintenance instructions, performance test report, inspection report and one year warrantee against defects.

The boiler inlet and outlet pipe connections shall be provided with isolating valves and thermometers of glass stem type.

The fuel oil supply pipe connection to the burner shall be provided with isolating valve, oil filter and fire safety valve. Fuel oil supply and return pipes shall be connected to the boiler by heavy duty flexible connections.

The boiler shall be mounted on reinforced concrete base of adequate dimensions to provide 10cms clearance on each side and above finished floor level.

B. Steel Boiler

The steel boiler shall be horizontal fire tube, scotch type of 7 bars water operating pressure at 120°C.

The boiler shall be mounted from the factory on a heavy structural steel skid type base.

The boiler shall have not less than 0.46 m² of heating surface per rated boiler horsepower.

The fire tubes shall be of 3mm. steel and shall be roller expanded and beaded into the tube sheets at each end. Welding of tubes into the tube sheets will not be accepted.

5.01 HOT WATER HEATING BOILER (CONT'D)

The boiler shell longitudinal joints shall be double butt welded and the girth joints full fillet welded. All welds shall be X rayed and stress relieved as required by the ASME Code.

The boiler shell shall be provided with an adequate number of 75 x 100mm oval handhole inspection openings on the sides and bottom, with an 28 x 38 mm oval manhole on the top, with two permanently attached lifting eyes and with all necessary threaded and flanged connections for boiler drain, water column, relief valves, controls, water inlet and outlet and smoke outlet all as required by the ASME Code.

The hot water outlet and return connections shall be located on the top center line of the boiler and shall be of such internal design as to provide forced internal thermal and directional circulation in order to mix the return water with the hot water within the boiler and prevent short circuiting, cold shocks and dead spots.

Access doors shall be provided at front and rear of the boiler to provide full access to tube sheets and fire tubes for inspection and cleaning without disconnecting any fuel piping or electrical wiring. The access doors shall be deviated or hinged and shall be lined with high quality refractory, fully gasket and bolted on for complete gas tightness. The rear access door shall be provided with refractory lined access opening to permit entry into the rear combustion chamber without opening the door. Pyrex observation ports shall be provided at each end of boiler for inspection of flame condition.

The boiler trim shall include but not necessarily be limited to :

1. Relief valves of type and size to comply with the requirements of the ASME Code.
2. Steel case 150mm. dial 0-14 bar range pressure gauge with shut off cock.
3. Cast brass 230mm. scale 0 to 120 °C range red reading mercury thermometer with separable socket well and extended neck.
4. Float operated low water cut off with drain valve at bottom.
5. Boiler drain valve.
6. Stack bimetallic thermometer.

The entire boiler, base frame and other components shall be factory painted prior to shipment with hard finish silicone enamel.

5.01 HOT WATER HEATING BOILER (CONT'D)**C. Cast Iron Boiler**

The cast iron boiler shall be of cast iron sectional type complete with insulated jacket.

The boiler assembly shall consist of cast iron sections and factory tested to 6 bars water operating pressure at 120 °C.

The boiler shall be provided with hinged access doors and inspection openings to provide full access to all fire surfaces for inspection, cleaning and maintenance without disconnecting any fuel oil piping or electrical wiring.

The access doors shall be lined with high quality refractory, fully gasket and bolted on for complete gas tightness.

The boiler shall be provided with all necessary threaded and flanged connections for boiler inlet and outlet, boiler drain, relief valve, controls and smoke outlet all as required by ASME code.

The boiler trim shall include but not necessarily be limited to:

- 1- Relief valves of type and size to comply with the requirements of the ASME Code.
- 2- Combination pressure altitude gauge and thermometer.
- 3- Operating and high limit thermostat
- 4- Stack bimetallic thermometer

5.02 PRESSURISING UNIT (EXPANSION TANK)

Refer to section (4) of this specifications.

5.03 PIPEWORK

Refer to section (2) of this specifications.

5.04 PIPEWORK INSULATION

Refer to section (2) of this specifications.

5.05 VALVES

Refer to section (2) of this specification

5.06 STRAINERS

Refer to section (2) of this specification

5.07 PIPE FLEXIBLE CONNECTORS

Refer to section (4) of this specification

5.08 DIFFERENTIAL PRESSURE REGULATING VALVES

Refer to section (4) of this specification

5.09 TWO PORT CONTROL VALVES

Refer to section (4) of this specification

5.10 HEATING PUMPS**End Suction Centrifugal Pump****1) Foundation and Setting**

The pump and motor shall be mounted on a common cast iron or steel base plate adequately reinforced against deflection and provided with drip rim and bolt holes.

The pump shall be directly connected to the motor through a heavy duty flexible coupling and provided with heavy gauge coupling guard from the factory. The base plate shall be securely supported on the foundation in such a way that proper pump and motor shaft alignment will be assured.

Horizontal split pumps shall be of a single stage volute type, with cast iron body, fully bronze fitted, double suction inlet, bronze impeller, flanged suction and discharge connections.

The base plate, with pump and motor mounted on it, shall be set level on the foundation and secured with proper size anchor bolts and completely grouted in to provide a rigid non deflating support. Pump and motor shall be aligned at the factory.

Realignment is required after grouting in of base plate and after connecting piping.

2) Pump Construction

The pump casing shall be of high tensile strength close-grained cast iron fitted with bronze wearing rings.

The impeller shall be bronze of the enclosed type and fitted to the shaft with stainless steel key. The impeller shall be dynamically balanced at the factory.

5.10 HEATING PUMPS (CONT'D)

The shaft shall be stainless steel amply sized to carry all axial and radial thrust. The shaft shall be protected by stainless steel sleeves.

The pump rotating element shall be supported by heavy duty grease lubricated ball bearings mounted in a heavy iron housing. The bearing shall be lubricated by screw type grease cups.

The pump shall be fitted with mechanical shaft seals which shall be easily removable from the stuffing boxes without disturbing motor and pump alignment.

The pump shall be provided with back pull-out casing for maintenance purposes.

The pump shall be provided from the factory with mating flanges for suction and discharge connections. The pump shall be provided with nameplate.

The pump shall be furnished with grease lubricated outboard bearings provided with drain plugs and fittings suitable for in service lubrication.

Mechanically; sealed condensing and chilled water pumps shall be provided with balanced seals.

Mechanically; sealed heating and hot water pumps shall be provided with John Crane Code Xp1d1 Type 1 unbalanced seals. Pumps provided with seals shall be provided with bronze or stainless steel shaft sleeves and stainless steel Cyclo-clean filters.

Packed pumps shall be fitted with stainless steel shaft sleeves heat treated or metallized to brinell hardness 500.

Stuffing box shall designed to accommodate a minimum five rings of packing plus spacer ring and shall be suitable for conversion to grease or water sealing. Packing shall be suitable for service scheduled in accordance to the pump manufacturer's recommendations.

3) Operating Characteristics

The pump shall be selected so that the operating point of specified flow and head falls near the point of maximum efficiency as obtained from the manufacturer published data. The pump shall never be selected to operate near the end of its curve.

The pump shall deliver not less than 150 percent of rated flow at a pressure not less than 65 percent of rated pressure. The shutoff pressure shall not exceed 120 percent of the rated pressure.

The impeller size shall not exceed 90% of the maximum size available for pump casing.

5.10 HEATING PUMPS (CONT'D)

A pump satisfying the specified flow and head characteristics but with smaller impeller size will be rejected. A large pump with a smaller impeller shall be selected to satisfy the specified flow and head.

4) Pump Instrumentation**a) Relief Valve**

The pump shall be provided with a relief valve set below the shutoff pressure to provide circulation of sufficient water to prevent the pump from overheating when operating with no discharge. A 20mm. relief valve shall be used.

Provision shall be made for a discharge to drain.

The relief valve shall be located between the pump and pump discharge check valve.

b) Automatic Air Release Valve

Each pump shall be provided with float operated air release valve not less than 15mm. size, to automatically release air from the pump.

c) Pressure Gauges

A pressure gauge shall be connected to the discharge and suction side of the pump casing.

d) Valves and Fittings

- Gate valves shall be installed on the suction and discharge piping of the pump.
- Globe valve shall be installed on the discharge bypass piping of the pump.
- Check valve shall be installed on the pump discharge piping.
- Strainer Y-type shall be installed on the suction piping of the pump.
- Flexible connections shall be installed on the suction and discharge piping of the pumps.
- All valves, strainers and fittings shall be of the same size as the pipe which they are installed.

5.10 HEATING PUMPS (CONT'D)**E. In Line Centrifugal circulating Pump**

The Contractor shall supply and install in line circulating pumps as shown and detailed on the drawings.

The pump shall be inline close coupled single suction centrifugal type. The pump shall have suction and discharge flanges of the same diameter and on the same centreline.

The pump motor shall be of squirrel cage induction type rated for continuous operation at ambient temperature not less than 40°C.

The motor shall be totally enclosed fan cooled type with insulation class F and IP54 protection.

The pump casing shall be of bronze or cast iron with gun metal impeller and stainless steel shaft. The construction shall have a pressure rating not less than 10 Bar at 85°C.

Pipe connections including fittings, valves, instrumentations etc. shall be as shown on the drawings.

Impeller sizes shall not exceed 80% of maximum size available for pump casing.

5.11 PACKAGED VARIABLE SPEED PUMPS

Refer to section (4) of this specification

5.12 SMOKE PIPES**A. Construction**

1. The smoke pipes for chimney stack and breaching shall be manufactured in accordance with DIN 18160 under quality controlled factory conditions. It shall be of twin wall construction having a 25mm insulated annulus between the inner and outer casing. For the exposed chimney the insulation thickness shall be 50mm.
2. Chimney sections and fittings shall twist lock together with a 1/8 turn using mating male and female couplers. A locking band secured by a toggle clip, shall be fitted at each joint. The outer casing shall be fixed to the couplers at each end and shall form the structural load bearing component. The inner liner shall be free to move as the flue gas temperature fluctuates.

B. Approval License

Smoke pipes should be provided with the DIN 18160 – approval mark.

5.12 SMOKE PIPES (CONT'D)**C. Quality Assurance**

The smoke pipes shall be manufactured under a Quality Assurance scheme administered by the British Standards Institute in accordance with BS 5750 part 2:1987, ISO 9002-1987, EN 29002-1987. Copies of appropriate certificates to be provided by the manufacturer.

D. Fire Rating

The smoke pipes should have a fire rating for stability and integrity of not less than 120 minutes as laid down in BS 476: Part 20: 1987. This would prevent the spread of fire from one compartment to another when fire stopped correctly providing that the structure through which it passed had a fire rating equal or greater. Copies of fire rating certificate should be available.

E. Performance

Working Pressure	:	Zero or negative at appliance outlet
Temperature (Max.)	:	540°C constant firing
	:	760°C intermittent firing.
Minimum	:	Inner liner not to be less than 10°C above acid dew point temperature.

F. Components

1. The smoke pipes shall comprise of a full range of lengths, fittings, terminals and accessories necessary to provide a complete chimney system.
2. The load bearing and wind load capacity of all components when installed within a system shall have been determined by the manufacturer using appropriate structural tests and analysis. Details of the maximum loading for each item shall be indicated in the installation instructions. The contractor shall submit to the "Engineer" relevant test reports in support of the above on demand.
3. A complete set of the bolts and nuts necessary for the correct assembly of each accessory shall be provided with each unit by the manufacturer.

G. Materials

Materials shall be as per the following schedule. Stainless steel shall be used throughout for the manufacture of all gas carrying components.

1. Lengths and Fittings

Inner Liner	-	316 grade
Outer Casing	-	304 grade
Locking Bands	-	304 grade
Terminals	-	316 grade

5.12 SMOKE PIPES (CONT'D)

Accessories	-	304 grade
Flashings	-	Aluminum and zincon

2. Material Thickness

Inner Wall	-	1mm
Outer Casing	-	0.7mm

Stainless steel as BS 1449 Part 2.

Flashings' aluminum / zincon

Aluminum	as BS 1470: 1987 99% pure
Zincon	as BS 6561: 1985

H. Insulation

The annulus between the inner liner and outer casing shall be packed to a constant density with Mineral wool fiber to give a thermal resistance of not less than 0.3m² K/W at 200°C hot face temperature.

Natural rock or blast furnace slag melts spun into fine fibers.

The heat resistance, stability and non-combustibility in accordance with DIN 4102.

Thermal conductivity to be measured in accordance with DIN 52612.

I. Installation

1. A set of installation instructions covering the installation of all components and accessories shall be provided by the manufacturer. They shall be packed with the components and accessories so as to be readily available to the installer on site. The installation of the complete system shall be strictly in accordance with the manufacturer's instructions.
2. The manufactures load bearing and lateral support accessories must be used in every case. Where the accessories require to be extended to suit site conditions an approved extension bracket shall be supplied and fitted.
3. Adequate access shall be provided through the smoke pipes to enable service personnel to clean the system without dismantling the chimney.
4. A condensate collector, as provided by the manufacturer, shall be installed throughout the system as necessary. The collector shall be fitted with a screwed boss to facilitate the installation of a drain pipe.

5.12 SMOKE PIPES (CONT'D)

5. The smoke pipes shall be fixed to the boiler outlet using a boiler adapter provided by the chimney manufacture. The adapter to be packed with fiber rope and fire cement to provide a gas tight seal. If necessary a purpose-made adapter shall be provided to make the transition from the boiler outlet to the manufacturer's adapter
6. A draught regulator shall be provided for each boiler.
7. Rain water cap shall be provided.

J. Packaging

1. Chimney components shall be adequately packaged at the factory to provide protection during transit or site storage. Large components shall be packed in cardboard cartons and strapped. Small components shall be vacuum packed in clear film on cardboard and complete with assembly hardware.
2. The manufacturer's catalogue number shall be clearly marked on all packages.

5.13 WATER TREATMENT

Refer to section (4) of this specification

5.14 DOSING POT

Refer to section (4) of this specification

5.15 DRAINAGE AND FLUSHING OF SYSTEM

Refer to section (4) of this specification

END OF SECTION

SECTION 7

Cold Water Services

DIVISION 15**MECHANICAL WORKS****SECTION 7.00****COLD WATER SERVICES****INDEX**

<u>CLAUSE NO.</u>	<u>TITLE</u>
7.01	General Requirements
7.02	Pipework
7.03	Valves
7.04	Thermal Insulation
7.05	Flushing
7.06	Testing and Commissioning
7.07	Chlorination
7.08	Float Valves
7.09	Water Tanks
7.10	Cold Water Boosting Pumpset

DIVISION 15**MECHANICAL WORKS****SECTION 7.00****COLD WATER SERVICES****7.01 GENERAL REQUIREMENTS**

The cold water system shall be executed as shown on the drawings, complete with all water distribution piping, water reservoir piping, roof water tanks, pumps, etc.

The Contractor shall be responsible for providing the main cold water supply pipe and accessories from the city mains including obtaining the necessary permits, performing all legal matters and making the tie-in to the water source in accordance with local codes, regulations and requirements of the water authorities having jurisdiction and including the provision of the water meter or orifice installation as might be required and as instructed by the authorities or the Engineer, all on his own account.

Underground water pipes shall not be run in the same trench as sewer pipes. Adequate precautions shall be taken for protecting underground water pipes from contamination from any source.

7.02 PIPEWORK**A. General**

Pipework inside buildings shall follow the lines of walls vertically and horizontally and shall be graded as necessary for draining and venting. Joints in pipework shall not be made within walls, or floors and where pipes pass through these structures they shall be sleeved. Where pipes pass through walls, floors, or ceiling exposed to view, they shall be fitted with chrome plated pipe covers. During the course of construction, open ends of pipework shall be sealed with compression type stop ends. Paper, wood, will not be allowed.

All pipe penetrations of lower and upper deck slabs and planters shall be made with puddle flanges.

All connections of copper tubes to threaded fittings shall be via adapters. Cut threads shall not be allowed.

For more details refer to section (2).

B. Building Domestic Cold Water Pipework

All domestic cold water pipework shall be galvanized steel to BS1387 medium grade.

For more details refer to section (2).

7.03 VALVES

All valves shall be as detailed in section (2).

7.04 THERMAL INSULATION

All cold water pipework exposed to view on roof shall be insulated and cladded as called for in section (2) of the specifications.

All other cold water pipework in shafts, voids, in walls, under tile, etc., shall not be insulated.

7.05 FLUSHING

The whole of the pipework installation shall be flushed out as detailed in section (2) of these specifications.

7.06 TESTING AND COMMISSIONING

The testing and commissioning of the cold water services shall be carried out as described in section (2) of these specifications.

7.07 CHLORINATION

After testing of the pipework and prior to making the connection to the new town mains supply all pipework shall be satisfactorily chlorinated in accordance with BS Code of Practice No. 310.

7.08 FLOAT VALVES

Float valves shall be of all bronze construction including levers and arms, with copper float and shall be suitable for a cold water working pressure of 10 bar. Float valves size 50 mm. and smaller shall have screwed inlets and size 65 mm. and larger shall have flanged inlets.

Float valves shall be of the full bore, equilibrium ball type, designed to close tight against maximum pressure when half submerged. They shall have renewable synthetic rubber valve disk and balancing piston bucket.

Float valves shall conform to BS 1212 and BS 1968.

7.9 WATER TANKS

Provision includes supply, delivery, installation, testing, commissioning and leaving in complete working order and maintain during maintenance period water storage tank as indicated on the drawing. The tank shall be hot press moulded insulated GRP panel construction. Capacity / dimensions of the tank shall be as indicated on the drawing. The tank shall be provided with heavy duty cover formed from standard panels and complete with manholes and air vents.

7.9 WATER TANKS (CONT'D)

Panels are moulded at temperatures of up to 150°C attaining the maximum material properties. The GRP panels shall be convex shaped and sandwiched with rigid polyurethane foam insulation of minimum of 25mm thickness. The insulated panels are used for the side, bottom and roof of the tank. The tanks shall have smooth internal and external finish to floors, walls and roof to prevent formation of algae, bacteria or fungi and to allow easy cleaning.

The panels shall not allow ultra-violet ray penetration. The panels must be fully pigmented and combined with u.v stabilized resins to prevent any light penetration which may cause algae growth.

Tanks shall be constructed in metric moulded in configurations of 1M x 1M or 0.5 x 1M or multiples thereof for side panels as per manufacturer's design. Panel sections are assembled with synthetic rubber sealant and bolted together with stainless steel SS 316 grade assembly bolts. The tank cover shall be provided with purpose made manholes. All bolts, nuts, flanges etc., in the water tank shall be in stainless grade SS 316.

The water tank shall be mounted firmly on to a cross girder type of steel skid base over the concrete base. Tank shall be provided with a bracing system that is designed and optimized to limit deformation of the structure and avoid point loadings on the panel. The panels to be rigidly supported by a combination of stainless steel SS316 tie-rods internally and galvanized box sections externally or with external bracings only as per the manufacturer's design and hot press moulded GRP corner sections. The roof panels shall be supported internally by UPVC tubular roof support staruts.

Tanks shall be fitted with PVC internal ladders and external aluminum access ladders air vent made of PVC with insect screen shall be included. The water tank shall be provided with plastic water level indicator complete with isolating valves.

The tank shall be filled with water and allowed to stand for 48 hours and to be examined for leaks and repaired as necessary.

7.10 COLD WATER BOOSTING PUMPSET

The Contractor shall supply and install cold water booster pump set as shown and detailed on the drawings. The pumpset shall be mounted on concrete base of 300mm height above finished level.

The pumpset shall be completely fully automatic locally assembled skid mounted unit includes the following features:-

- a. Two duty pumps with their motors.
- b. Galvanized steel frame
- c. Galvanized suction and delivery manifolds with flanged connections
- d. Isolating valves and flexible connections on suction and delivery of each pump.
- e. Check valve on delivery of each pump
- f. Strainer on suction of each pump

7.10 COLD WATER BOOSTING PUMPSET (CONT'D)

- g. Pressure gauges, pressure switches and pressure relief valves
- h. One pressure vessel diaphragm type
- i. Automatic control panel.

Pressure vessel shall be welded mild steel cylindrical vertical type to BS 5169. The pressure vessels shall be provided with pressure gauge, lifting lugs, level gauge, safety valve, drain cock, and inspection manhole.

The pump motor shall be squirrel cage induction type and rated for continuous operation at ambient temperature not less than 40°C.

The motor shall be totally enclosed fan cooled type with insulation class (F) and IP54 protection and rated for 400 volt, 3-phase and 50 cycle.

The automatic control panel shall consist of the following:

- 1 Starter with overload for each motor.
- 1 Residual current circuit breaker (for each pump)
- 1 Set timing relays
- 1 Hand/off/auto switch for each pump
- 1 Run & trip lamps for each motor
- 3 Indicating lamps, "Power On", "Low Water", and phase failure
- 1 Main neutral link
- 1 Cyclic controller
- 1 Dry run prevention relay and floats switch in feed tank

Construction of panel to be to section (12) of this specification.

The duty pumps shall start with a 15 seconds time delay (adjustable) between each pump.

The "hand" button shall be spring loaded and shall override all control circuits (except overload) so that the selected pump can be checked for operation.

The pump set shall operate under the control of pressure switches

The control panel design shall ensure:

- a. Automatic operation of all pumps under the control of pressure switches and cyclic relay. The duty pump selection switch shall be in 'Auto' position.
- b. The HAND position of H-O-A switches is only for testing of pump and shall be spring loaded. Alternatively non latching push button shall be used for starting pump in HAND mode.
- c. Dry run protection based on level switch in the feed tank with indication.
- d. Volt free terminals for remote indications of common fault including low water level in feed tank and power OFF.

END OF SECTION

SECTION 8

Hot Water Services

DIVISION 15**MECHANICAL WORKS****SECTION 8.00****HOT WATER SERVICES****INDEX**

<u>CLAUSE NO.</u>	<u>TITLE</u>
8.01	General Requirements
8.02	Pipework General
8.03	Domestic Cold Water Pipework
8.04	Valves
8.05	Thermal Insulation
8.06	Hot Water Cylinder
8.07	Hot Water Return Pump
8.08	Testing

DIVISION 15**MECHANICAL WORKS****SECTION 8.00****HOT WATER SERVICES****8.01 GENERAL REQUIREMENTS**

The hot water system shall be executed as shown on the drawings, complete with all water distribution piping, pumps, etc.

8.02 PIPEWORK GENERAL

Pipework inside buildings shall follow the lines of walls vertically and horizontally and shall be graded as necessary for draining and venting. Joints in pipework shall not be made within walls, or floors and where pipes pass through these structures they shall be sleeved. Where pipes pass through walls, floors, or ceiling exposed to view, they shall be fitted with chrome plated pipe covers. During the course of construction, open ends of pipework shall be sealed with compression type stop ends. Paper, wood, will not be allowed.

All pipe penetrations of lower and upper deck slabs and planters shall be made with puddle flanges.

All connections of copper tubes to threaded fittings shall be via adapters. Cut threads shall not be allowed.

8.03 DOMESTIC HOT WATER PIPEWORK**A. General**

All domestic hot water pipework shall be copper tube to BS 2871 Part (1) Table (X) half hard tubes supplied in straight lengths and plastic coated.

For more details refer to section (2).

8.04 VALVES

All valves generally shall be as detailed in section (2).

8.05 THERMAL INSULATION

All hot water pipework shall be insulated as called for in section (2).

8.06 HOT WATER CYLINDER

- a. Type- Each water heater shall be of the type shown by the schedule on the drawings and shall heat domestic water with hot water for from the heating system.

8.06 HOT WATER CYLINDER (CONT'D)

- b. Capacity- The storage capacity and recovery shall be as shown on the drawings.
- c. Heating Element- The heating element shall have a surface area of not less than one square foot for every 20 gallons (one square meter for every 800 Lt.) to be heated in one hour. The heating element shall be attached to the tank with a flange, complete with gasket and bolts.
- d. Tubes- The tubes shall be copper "U" bends expanded into a steel, copper lined tube sheet. The tubes shall be installed in a manner that will ensure positive drainage. Non-ferrous tube supports shall be provided where necessary to maintain proper tube alignment.
- e. Controls- An automatic control valve shall be installed in the return line. A thermostat shall operate the control valve to maintain the proper temperature.
- f. Tank- Tank shall have all necessary tappings, including tap for aquastat, standard manhole, and steel supports. Tank shall be constructed of 6mm thick galvanized steel.
- g. Accessories- Provide a 9-inch (229 mm), 0 degrees F-210 degrees F (17 degrees C to 99 degrees C) range thermometer and an ASME approved and rated pressure and temperature relief valve. The thermometer shall be placed in the hot water tank where recommended by the manufacturer and as close to high level as possible.
- h. Test and Certification- The water heater shall have a working pressure of 125 psi (8.6 bar) and shall be hydrostatically tested for 1-1/2 times the working pressure.
- i. Insulation- The hot water cylinder shall be insulated with 1-1/2" (40 mm) foam insulation and protected with 0.8mm aluminium cladding.

8.07 HOT WATER RETURN PUMP

The Contractor shall supply and install the hot water return pumps (Ref: HWRP-1) as shown and detailed on the drawings.

The pump shall be inline close coupled single suction centrifugal type. The pump shall have suction and discharge flanges of the same diameter and on the same centerline.

The pump motor shall be of squirrel cage induction type rated for continuous operation at ambient temperature not less than 40°C.

The motor shall be totally enclosed fan cooled type with insulation class F and IP54 protection.

The pump construction shall be all stainless steel have a pressure rating not less than 10 bar.

8.07 HOT WATER RETURN PUMP (CONT'D)

Pipe connections including fittings, valves, instrumentations etc. shall be as shown on the drawings.

8.08 TESTING

The testing of domestic hot water system shall be carried out as described in Section (2) of these specifications.

END OF SECTION

SECTION 9

Fuel Installations

DIVISION 15

MECHANICAL WORKS

SECTION 9.00

FUEL INSTALLATIONS

INDEX

CLAUSE NO

TITLE

9.01	Scope of Work
9.02	Fuel Oil Storage Tanks (Under Ground)
9.03	Pipework
9.04	Valves
9.05	Fuel Oil Daily Tank
9.06	Fire Valve
9.07	Filters

DIVISION 15**MECHANICAL WORKS****SECTION 9.00****FUEL INSTALLATIONS****9.01 SCOPE OF WORK**

The Works shall comprise all necessary items to provide the complete installation of a fuel oil storage and distribution systems as generally described hereunder.

9.02 FUEL OIL STORAGE TANKS (UNDER GROUND)

The under ground fuel tank shall be cylindrical with fixed long radius convex ends fabricated from 6mm thick high quality black steel plates of welded construction on both the internal and the external seams.

The tank shall be hydrostatically tested at the factory after fabrication to a pressure of one atmosphere held for 24 hours and all welds shall be proved sound.

The tank shall be provided on its top with a 50cm round manhole constructed of 6mm thick side, flange and cover and welded to the tank. The manhole cover shall be fitted to the flange with a 1.5mm thick asbestos composition ring gasket and 20mm dia by 40mm long manhole bolts and nuts equally spaced around 60cm dia bolt circle.

The tank shall be provided with the necessary flanged connections at location of size as shown on the drawings.

All tank connections shall be made of black forged steel pipe couplings fittings through holes cut in the tank walls and welded all around inside and outside of the tank wall. The drain connection shall be made of black forged steel pipe half coupling fitted through a hole cut in the tank bottom and welded all around inside and outside with inside end flush with tank bottom.

The tank including manhole and all connections shall be thoroughly cleaned of rust, scale, welding slag, oil, grease and all foreign matters by sand blasting or wire brushing down to the base metal and painted on the outside only with two coats of zinc chromate primer and two coats of aluminum paint.

The tank shall be set on steel craddles, and mounted on a concrete base.

The tank shall be provided with oil content gauge and to be location in boiler room.

9.03 PIPEWORK

Black steel seam welded to BS 1387 Class (B) shall be used.

The fittings shall be of the screwed forged steel type suitable for backwelding.

All underground pipework shall be wrapped with two lays of hessian and tar.

9.04 VALVES

Refer to section (2) of this specification.

9.05 FUEL OIL DAILY TANK

Daily storage tanks shall be of cylindrical or rectangular type, mounted on concrete base and angle supported steel base above ground, and shall be constructed from mild steel welded sheets to the size as indicated on the Drawings.

Tanks shall be internally painted by three layers of primer painting before applying two dense layers of oil resistant material. Tanks shall be externally painted by three layers of primer layers and painted with oil resistant and non-stainable two layers of final paints colors shall be in accordance to API standards.

The tank shall be complete with the following connections and fittings:-

- One 25 mm screened air vent.
- One 25 mm fill-lines from main underground fuel tank complete with isolation valve.
- One 25 mm over flow line complete with sight glass to indicate over flow.
- One Oil contents gauge with scale calibrated in liters capacity. Gauge mechanism to be housed in a weather-proof "clear vision" enclosure.
- One 600 mm diameter or rectangular access openings. Each opening is to be fitted with a raised flanged lid securely hinged to the tank and sealed by gasket to provide tight joint against water admittance.

9.06 FIRE VALVE

A fire valve of the same size as the oil main. The fire valve shall be of the electronic style, heat detectors shall be located over each burner/engine on each item of plant fed from the oil installation.

9.07 FILTERS

The filters shall be line size, tested to 20.6 bar and shall have gunmetal body and covers, stainless steel internals with a stainless steel mesh element and be complete with brass drain plug. The elements shall be capable of filtration down to 100 microns.

END OF SECTION