AIR FILTERS

1. GENERAL

1.1 Scope

.1 Pleated filters.

1.2 Quality Assurance

.1 Filters shall be product of and supplied by one manufacturer.

.2 Filter media shall be UL listed, Class I or Class II.

.3 Filter components assembled to form filter banks shall be products of same manufacturer.

.4 All filters except HEPA shall be in accordance with ASHRAE Standard 52.

.5 Filters containing asbestos, urea formaldehyde or fibreglass shall not be acceptable.

1.3 Alternatives

.1 Size, media face area, material, test efficiency, initial and final air resistance of alternative manufacturers shall be as specified.

1.4 Submittals

.1 Provide shop drawings of all filters, and filter racks/housings.

2. PRODUCTS

2.1 Frames

.1 Fabricate filter frames and supporting structures of galvanised steel or extruded aluminum with necessary gasketting between frames and walls. Provide holding frames 1.6 mm "T" section construction.

.2 Provide standard size frames to provide interchangeability of filter media of other manufacturers.

2.2 Pleated Filters

.1 Media: The filter shall be constructed of non-woven reinforced cotton rayon. A diamond grid with 98% open area shall provide support for the media. The media shall be bonded to media support to ensure pleat stability. A rigid, moisture resistance heavy duty kraft board shall enclose the media. The filter pack shall be bonded to the inside periphery of the frame to eliminate air bypass.

.2 The efficiency shall be 30-35% based on ASHRAE 52 up to 2.54 m/s for 25 mm and 50 mm thick.

.3 Filters containing asbestos, urea formaldehyde or fibreglass will not be accepted.

2.3 Spare Parts

.1 5 sets of spare filters

3. EXECUTION

3.1 Installation

.1 Construct and install filters to prevent passage of unfiltered air. Provide felt, rubber or neoprene gaskets.

.2 Do not operate fan system connected to filter banks until filters (temporary or permanent) are in place. Provide new filters at take-over by the Owner. Replace filters used during construction.

.3 Provide filter banks in arrangement shown with removal and access indicated.

3.2 Performance

.1 Not applicable.

END OF SECTION

CONTROLS

1. GENERAL

.1 The control sequences contain a general description of the intent of the operation of the systems to be controlled. The Contractor shall review individual systems to ensure equipment and life safety interlocks are not overridden.

.2 The relationships between the points, systems and building are described in the control sequences.

.3 Review with the Engineer during the shop drawing stage to finalise the control sequences for each system.

.4 Provide control systems consisting of thermostats, dampers, operators, indicating devices, interface equipment and other apparatus required to operate mechanical system and to perform functions specified.

.5 Provide electric control system.

.6 Provide control devices, components, wiring and materials.

.7 Provide instructions for Owners.

.8 Coordinate the work of this section with work of Division 16 and Division 17.

2. PRODUCTS

2.1 Control Valves

.1 Two-way and three-way valves for liquids: Two-way valves shall have equal percentage characteristics and three-way valves shall have linear characteristics. Size two-way valve operators to close against maximum pump shut-off head. Ball valves as control valves are not acceptable.

.2 Size control valves as per following criteria:

- Select two-way control valves for coils, heat exchangers, terminal units, etc., with a minimum pressure drop of 35 k and a maximum pressure drop of 70 kPa.
- Select three-way control valves for coils for pressure drop equal to three times the equipment pressure drop up to maximum 70 kPa.

.3 Provide valves complete with electric operators.

.4 Two Way Valves for Radiation and Unit Heaters:

.1 Globe valve, threaded ends, bronze body, stainless steel trim, *689 kPa* rated, double O-ring packing.

.5 Three Way Valves for AHU coils:

.1 Globe valve, threaded ends, bronze body, stainless steel trim, 1722 kPa rated.

2.2 Damper Actuators

.1 Generator Ventilation System Modulating Actuator: Electric motor, spring return, 90° - 160° adjustable stroke, electronic drive circuit, electro-mechanical brake, internal transformer, rated ambient temperature range -37°C to 54°C, operating torque 5.7 N-m, breakaway torque 22.6 N-m. Provide damper linkage for all actuators, minimum position potentiometer on DM-21 actuator. Standard of Acceptance: Honeywell M955C Super Mod with Q605 damper linkage, one Q209 minimum positive potentiometer, BYK resistor kit for unison damper control.

.2 Summer Ventilation System Two Position Actuator: Electric motor, spring return, 90° - 160° adjustable stroke, electronic drive circuit, electro-mechanical brake, internal transformer, rated ambient temperature range -37°C to +54°C, operating torque 5.7 N-m, breakaway torque 22.6 N-m. Provide damper linkage. Install 150 ohm, 0.5 watt resistor from 4074BYK resistor kit between B and W motor terminals for two position operation. Honeywell M955C Super Mod with Q605 damper linkage and 150 ohm resistor.

2.3 Dampers

.1 Sizes

.1 Blades maximum 150 mm wide and 1200 mm long.

.2 Materials

.1 Frame: 2.5 mm thick extruded aluminum, insulated with polystyrene foam R-5.

.2 Blades: extruded aluminum with internal hollows insulated with 22 mm thick polyurethane foam and thermal breaks.

.3 Bearings: double sealed, celcan inner bearing, polycarbonate outer bearings.

.4 Linkage and Shafts: aluminum hexagon rod.

.5 Seals: replaceable synthetic rubber seals side, top and bottom of frame and along all blade edges.

.3 Performance Characteristics:

.1 Temperature range minus 40°C to 90°C.

.4 Standard of Acceptance: TAMCO series 9000 low leakage/thermal break insulated damper.

3. EXECUTION

.1 Provide data base for all hardware points listed for system operation to meet specification operating sequences.

.2 All controllers are to be installed to ensure accessibility from the floor.

.3 Identify all control components with Lamacoid plates.

.4 Identify all control wiring with numbers at each device and panel.

.5 In general, transmitters, switches and some indicators are locally mounted. Mount all other components in control cabinets.

.6 Components in pipes: mount using separate wells so that removal of component does not cause loss of fluid from pipe.

.7 Components on sheet metal ductwork: mount using metal mounting brackets attached to ductwork with sheet metal screws or bolts. Support all flexible type elements.

.8 Remotely mount device if vibration of pipe, duct equipment can harm device or cause erroneous readings.

.9 Position thermometers and temperature gauges so that they are easily seen by a person standing on the floor.

.10 Install all components so that they can be removed using normal hand tools (screwdrivers, wrenches, etc.). Do not use pop rivets or welding.

.11 All electrical work consistent with Electrical Specification.

.12 Select transmitters, thermostats, pressure gauges, indicators, etc., so that normal operating point is approximately mid-point of instrument range.

.13 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats 1500 mm above floor unless specified otherwise.

.14 Install damper motors on outside of ducts. Do not locate in outside airstream.

.15 **All temperature indicators and selectors to be in Celsius degrees.**

4. CONTROL SEQUENCES

4.1 Unit Heaters

.1 The surface mounted electric heat/cool thermostat shall cycle the fan motor on a drop in space temperature.

4.2 Fuel Oil System

.1 Fuel from the outdoor tank is transferred to the fuel warming pipe via gravity.

.2 Level switches are to be provided in the day tank, wired to the PLC by Division 17.

4.3 Emergency Generator Room Ventilation

.1 When the emergency generator starts, the outdoor air damper shall open to minimum position.

.2 As the space temperature changes, the room thermostat shall modulate the outdoor air, exhaust air and recirculation air damper to maintain set point.

.3 Upon generator shutdown, the outdoor air, minimum outdoor air, and exhaust air dampers are closed and recirculation air damper is opened.

.4 Hard wired electric controls are to be used. All controls shall be on stand-by power.

4.4 Heating System

.1 Boilers B-1 and B-2

.1 Boiler controls are provided by the boiler manufacturer.

.2 Provide all safety or operational interlocks to boiler control panels as required.

.3 Boilers generate heating propylene glycol at 88°C.

.4 Boiler duty / standby selection is automatic by the boiler control panel.

.2 Building Heating Loop

.1 Building heating loop consists of pump P-1 and P-2 piped in a single primary loop to the building heating loop and air handling unit (AHU-1) coil.

.2 P-1 and P-2 are 100% capacity each (duty/standby), and are normally activated via the boiler control panel. When outdoor temperature drops below *18°C*, the duty pump shall start. Program shall have *5°C* deadband to prevent excessive pump cycling.

.3 Supply temperature to building heating loop is reset as follows:

O/A Temp.	HWS
-5°C or less	88°C
10°C	60°C

Temperature control is achieved by cycling the duty boiler.

4.5 Summer Ventilation

.1 Summer Ventilation Exhaust Fan EF-1: A hand-switch located in the Service Room will cause exhaust damper to open and EF-1 to start. An auxiliary damper motor end-switch on the exhaust damper will open the intake damper. System operation is to be locked out if boiler hand-switch is in the on position through a hardwired connection

4.6 Air Handling Unit

.1 AHU-1

.1 The air handling unit AHU-1 is a two speed unit serving the Wet Well and Pump House.

.2 The unit is mounted indoors and consists of a supply fan, heating coil, filters and mixing box.

.3 Air is relieved through pipes into the Wet Well and Pump House through the roof.

.2 System Start/Stop

.1 The air handling unit will normally be energised at low speed and outdoor air damper is open 100%.

.2 The system will be switched to high volume for any one of the following events:

.1 Outside air temperature greater than 10°C.

.2 Local over ride switch is engaged.

.3 Combustible gas detection alarm.

.4 H_2S gas detection alarm.

.3 Freeze Stats

.1 Provide averaging type freeze stat in the air handling unit at location indicated. Upon sensing a low temperature, the supply fan shall stop, and all outdoor and exhaust air dampers shall close. The freeze stat must be reset manually.

4.7 Domestic Water Pressure System

.1 Pump P-3 is controlled by a pressure switch supplied with the tank package to maintain minimum set pressure. Provide pump/float switch interconnect wiring to shut down pump on low level in holding tank TK-3. Provide a visual alarm to indicate pump is shut down on low level in holding tank.

4.8 Domestic Hot Water System

.1 Integral controls for domestic water heater maintain the water supply temperature setpoint.

END OF SECTION

LIST OF SCHEDULES

1. LIST OF SCHEDULES

.1 Air Handling Unit Schedule

.2 Exhaust Air Fan Schedule

.3 Unit Heater Schedule

.4 Boiler Schedule

.5 Radiator Schedule

.6 Tank Schedule

.7 Pump Schedule

.8 Air Outlet Schedule

.9 Domestic Water Heater Schedule

LIST OF SCHEDULES

Air Handling Unit Schedule

Tag	AHU-1
Location	Service Room
Area Served	Pump House / Wet Well
Type	Fan Coil
Manufacturer	Commercial Aire
Model	HOHD24
Supply Fan	
Volume (L/s)	145 / 290
ESP (Pa)	125
Fan Type	FC DWDI
Fan Speed (rpm)	800
Motor Power (kW)	0.25 (1/3 HP)
Power Supply	120/1/60
Minimum Outdoor Air (L/s)	100%
Heating Coil Section	
Coil Capacity (kW)	22.0
EAT (°C)	-42.0
LAT (°C)	18.0
Max Face Velocity (m/s)	2.5
Media	50% Prop. Gly./Water
Rows	4

LIST OF SCHEDULES

Exhaust Air Fan Schedule

Tag	EF-1
Function	Summer Ventilation
Location	Service Room
Volume *(L/s)*	180
E.S.P. Press *(Pa)*	65
RPM	1500
Motor Power *(kW)*	235
Power Supply (V/Ph/Hz)	115/1/60
Drive	Belt
Type	In Line
Manufacturer	Penn Barry
Model	Z10S
Control	Reverse-acting thermostat
Accessories & Remarks	

LIST OF SCHEDULES

Unit Heater Schedule

Tag	UH-1
Location	Service Room
Heating Medium	50 / 50 Prop. Gly.
Capacity *(kW)*	17.75
Liquid Entering Temp *(°C)*	88
Liquid Leaving. Temp *(°C)*	77
Design Liquid Flow *(L/s)*	0.6
Liquid P.D. *(kPa)*	0.9
Air Flow *(L/s)*	540
RPM	1150
Motor Power *(W)*	125
Power Supply (V/Ph/Hz)	120/1/60
Arrangement	Horizontal
Manufacturer	Sigma
Model	84-H
Accessories & Remarks	

NOTE: Capacities shown are actual capacities using 50% propylene glycol.

LIST OF SCHEDULES

Boiler Schedule

Tag	B-1	B-2
Manufacturer	Weil McLain	Weil McLain
Model	WGO-5	WGO-5
Fuel Oil flow (L/hr)	5.5	5.5
Rated Heating Output (kW)	50.6	50.6
EGT (°C)	77	77
LGT (°C)	88	88
Flow Rate (L/s)	1.3	1.3
Heating Media	50 / 50 Propylene Glycol / Water	50 / 50 Propylene Glycol / Water
Electrical (V/ph/Hz)	120/1/60	120/1/60
Motor (kW)	0.25	0.25
Remarks	c/w flame retention burner	c/w burner Power Flame WCR2-OAS

LIST OF SCHEDULES

Radiation Schedule

Tag	R-1
Location	Various
Fluid Entering Temp *(°C)*	88
Fluid Temperature Drop *(°C)*	11
No. of Rows/Passes	1
Height *(mm)*	457
Capacity *(kW/m)*	1090
Type	Wall fin radiation
Manufacturer	Sigma
Model	RW18F
Accessories & Remarks	

NOTE: Capacities shown are actual capacities using 50% propylene glycol.

LIST OF SCHEDULES

Tank Schedule

Tag	TK-1	TK-2	TK-3
Service	Fuel Storage Tank	Glycol Expansion Tank	Domestic Water Storage Tank
Location	Outside Building	Mechanical Room	Service Room
Type	Double Walled	Expansion Tank	Atmospheric
Capacity *(litre)*	2400	167	1500
Diameter *(mm)*	1295	560	-
Height/Length *(mm)*	2415	895	1370 (l) x 610 (w) x 1930 (h)
Manufacturer	Northern Steel	Amtrol	ZeeBest Plastics
Model	Horizontal	Extrol SX-90V	DOM330
Accessories & Remarks	Refer to specifications	130 L acceptance volume	
Tag	**TK-4**	**TK-5**	
Service	Domestic Water Pressure Tank and Pump Package	Glycol Fill Tank	
Location	Service Room	Lower Floor Mechanical Room	
Type	Pressure Tank	Custom Atmospheric	
Capacity *(litre)*	50	180	
Diameter *(mm)*	380	610	
Height/Length *(mm)*	650	1245	
Manufacturer	Myers	Axiom	
Model	HJ33C-TH13	SF100	
Accessories & Remarks	c/w Pump P-3 pressure gauge and pressure switch	c/w pump P	

LIST OF SCHEDULES

Pump Schedule

Tag	P-1	P-2	P-3	P-4
Function	Primary Glycol Heating	Primary Glycol Heating	Domestic Water Pressure System	Glycol fill
Location	Mechanical Room	Mechanical Room	Service Room	Mechanical Room
Type	Vertical In-line	Vertical In-line	Shallow Well Jet Pump	Vertical In-line
Impeller	304 SS	304 SS	Reinforced thermoplastic	Non-ferrous
Casing	Cast Iron	Cast Iron	Cast Iron	Cast Iron
Medium Pumped	Heating Glycol	Heating Glycol	Potable Water	Glycol
Design Pressure *(kPa)*	103.5	103.5	690	345
Max. Operating Temp. *(°C)*	120	120	110	150
RPM	1800	1800	3500	-
Design Flow Rate *(L/S)*	1.26	1.26	0.4 @ 276 kPa discharge head and 1.5 m suction lift	0.06
Discharge Head *(kPa)*	60	60	276	345
Suction/Discharge Sizes *(mm)*	32	32	20	-
Motor Power *(kW)*	0.375	0.375	0.225	0.7 Amps
Power Supply (V/ph/Hz)	120/1/60	120/1/60	120/1/60	115/1/60
Manufacturer	Grundfos	Grundfos	Myers	Axiom
Model	UPS32-80	UPS32-80	HJ33C-TH13	SF100
Remarks	100% duty / standby	100% duty / standby	Part of TK-4 tank package	Part of TK-5 tank package

LIST OF SCHEDULES

Air Outlet Schedule

Type	Description	Manufacturer	Model
S-1	Louvred face double deflection supply air grille, 20 mm blade spacing, front blades parallel to short dimension, aluminum construction, sidewall mounted, off-white baked enamel finish	E.H. PRICE	SIZE/620/S/B13
E-1	Egg Crate return/transfer air grille, extruded aluminum border and frame, sidewall/ ceiling mounted, off-white baked enamel finish.	E.H. PRICE	SIZE/80A/F/A/B13

LIST OF SCHEDULES

Domestic Water Heater Schedule

Tag	DWH-01
Service	Domestic Hot Water
Location	Under counter in Service Room
Manufacturer	State
Model	CPE 10 10MSA
Dimensions	
Capacity (L)	38
Height (mm)	450
Diameter (mm)	450
Input (kW)	6
Recovery Rate (L/hr @ 56°C)	106
Electrical (V/ph/Hz)	240/1/60
Remarks	

END OF SECTION