



Nelson Mandela Place  
GLASGOW

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**M&E proposed upgrade specification**

This is an extract of the provisional M&E upgrade specification as the works have not yet been let.

#### 1.01 GENERAL:

This contract covers the design, supply, delivery to site, connection, erection, commissioning and user training of replacement Chiller, Boiler, Pumps, Toilet Extract Fans, CCTV, BMS and ancillary services as outlined in the Specification, and all in accordance with the contract documentation and Prelims. It is the contractors responsibility to provide a complete functioning mechanical and electrical installation to the standards and descriptions in this and the description of works document. The Contractor Shall be appointed the Principal Contractor for the works under the CDM regulations 2007.

The requirements for each system shall include as necessary, all hardware, software and services required to perform the functions and pre-conditions of this sub-contract document to facilitate progressive (and phased) commissioning and setting to work. This specification shall be deemed as the technical standards pertaining to the works described in the contract documents.

Draft Programme:

- Boiler and LTHW pump replacement commence 1<sup>st</sup> June 2008, Complete 1<sup>st</sup> July 2008
- Chiller and associated Pump Replacement commence 22<sup>nd</sup> September 2008 Complete 13<sup>th</sup> October 2008-03-31
- Controls and all others works to commence 19<sup>th</sup> May 2008 and be complete by 13<sup>th</sup> October 2008.

#### 1.1 Toilet Extract Fans:

Replace 2 no. twin-fan roof mounted toilet extract fans including controls, making all necessary alterations to plinth, ductwork etc. to form a fully operating and commissioned installation.

Fans shall be:

- Fabricated from GRP in Birch grey with full size removable side covers and top discharge weathering cowl.
- The internal twin fan assembly shall be constructed with twin EFF1 polyphase motors to the standards of IEEMA : 19-2000. Drive shall be Poly V Belt.
- The fans shall be of double inlet, double width aerofoil bladed type with sealed ball race bearings rated for at least 20,000 hours.

- An airflow proving switch shall be provided.
- The entire fan assembly shall be isolated from the casing by flexible connections and anti-vibration mountings.

Ductwork shall be modified to suit the new fans and the new fan ordered in the correct configuration to match the inlet and maximise service access.

The fan shall be provided with new externally mounted IP54 rated lockable isolators and shall be integrated into the existing control and changeover system including airflow proving switch. The fan shall be sealed and mechanically fixed to the new base.

Fan Type :-

East – Kiloheat 9D BTZ 225 with 0.75kw 4pole 3 phase motors, external model c/w airflow switch and AC panel, 3DC02 with duty share and volt free contacts

West – Kiloheat 9D BTZ 225 with 1.1kw 4pole 3 phase EFF1 rated motors, external model c/w airflow switch and AC panel, 3DC09 with duty share and volt free contacts

The existing fans are to be removed and scrapped, providing waste transfer certification.

## 1.2 Automatic Controls –

### System Control Overview

#### Boiler Plant

The existing boiler plant shall be replaced with new boilers complete with a suitable interface to a Priva BMS.

#### Chiller Plant

The existing chiller plant shall be replaced with a suitable chiller complete with a Modbus/Bacnet interface to the Priva BMS. Values can be read from the BMS front end in a graphical format. The chiller strategy shall be programmed in such a manner that the flow temperature set point will vary based on the system cooling demand.

#### Floor Valves

Heating and Cooling control valves shall be installed within each floor level which shall operate based on occupancy. Each floor is served via the Variable temperature and Fan Coil Unit pumps which are controlled directly via their own integral DP switches. As each floor valve opens/closes a DP switch detects variations in back pressure modulating the pumps to maintain a desired set point.

#### Ventilation

The ventilation for the building is divided into the following plants:-

- East Area Office Areas AHU
- West Area Office Areas AHU
- East Area Toilet Areas AHU and Extracts
- West Area Toilet Areas AHU and Extracts

#### East & West Zone Office Areas

AHU's serving the office areas consist of the following:-

- 1 - Supply Fan
- 1 - Extract Fan
- 1 - Heating Valve
- 1 - Cooling Valve
- 1 - RAC Pump
- 1 - Filter
- 1 - Supply Duct Temperature
- 1 - Extract Duct Temperature

#### Time Control

The AHU plant shall start based on floor demands. By installing VSD's the BMS can perform control algorithms to optimize the fan speed based on room set point and calculated building occupancy.

#### Temperature Control

The RAC pump, heating valve and cooling valves shall be modulated to achieve a calculated set point based on the buildings heating and cooling demand. This shall be calculated based on a combination of space and return air temperature which shall reset the supply duct temperature accordingly.

In summer periods where the space temperature demands primarily cooling in the morning, a Pre-Cool program shall automatically be enabled to pre-purge the building with cool air to minimize the need for chilled water first thing in the morning.

#### Frost protection

A hard wired frost stat is provided to shut down the supply fan if the duct temperature falls below 5 deg/C. In addition to this the RAC pump shall be enabled and the heating valve shall modulate to 100% open. When the frost stat breaches 5 deg/C the AHU plant shall return to normal operation.

#### Filter Monitoring

A DP switch shall monitor the condition of the AHU filter. As the filter gradually becomes dirty the DP switch shall raise an alarm on the BMS front end PC after a predetermined period.

#### East & West Zone Toilet Areas

AHU's serving the office areas consist of the following:-

- 1 - Supply Fan
- 2 - Extract Fan
- 1 - Heating Valve
- 1 - Filter
- 1 - Supply Duct Temperature

#### Time Control

The AHU plant shall start based on floor time demands.

#### Temperature Control

The heating valve shall be modulated to achieve the desired supply duct set point.

#### Frost protection

A hard wired frost stat is provided to shut down the supply fan if the duct temperature falls below 5 deg/C. In addition to this the heating valve shall modulate to 100% open. When the frost stat breaches 5 deg/C the AHU plant shall return to normal operation.

### Filter Monitoring

A DP switch shall monitor the condition of the AHU filter. As the filter gradually becomes dirty the DP switch shall raise an alarm on the BMS front end PC after a predetermined period.

### HWS Plant

The BMS starts and stops the HWS plant based on occupancy times. Times should include for cleaners occupancy as required.

This is based on supplying the following as a minimum to provide a complete commissioned system :-

### Hardware

- Priva BMS control system
- Front End PC complete with graphics, alarming and sensor logging.
- ABB/ Danfoss HVAC Drives serving AHU Fans
- Replacement local isolators (where necessary)
- Replacement of faulty sensors (where necessary)
- –port floor heating and cooling valves

### Installation

- Installation of VSD Units
- Installation of additional room sensors
- Installation of additional floor control valves
- Installation of new SY rated braided cable between VSD Units and motors
- Installation of control cabling between the control panel and the VSD Units
- Modification of control panels

### Engineering and Commissioning

Commissioning of VSD Units and associated DDC control system

### Project Management

Provision of Documentation (Risk Assessments, Method Statements, O&M Data)

Management of installers

Site surveys

Full system demonstration and client instruction to be carried out on site, once the system has been commissioned.

'As fitted' documentation to be provided including complete (new and existing equipment) wiring diagrams and system software logic in electronic and paper formats.

### 1.3 Boilers

Heat output from each boiler module shall be 50kW (Super Plus) with the number of modules in use dependent on the maximum load. Fitted on slide rails, the modules shall be located in an insulated stainless steel boiler casing.

#### Boiler Casing

Water flowing through the upper modules is to be kept warm by exhaust gas from lower modules which are firing. There shall be only a minimal loss of efficiency as modules shut down. Modules are to be connected in parallel across the two headers via flexible hose connections. The Boiler shall comply with the new Building Regulations 2000 - Conservation of Fuel & Power (Part L). With an approved efficiency of at least 94% net (85% gross) full load, at part load high efficiencies are to be maintained at virtually full load levels.

The stainless steel boiler casing shall be externally insulated with stucco finish, aluminium-faced insulation. Module covers are to be stove-enamelled.

The heat exchanger shall consist of extruded copper finned tubes in a circular arrangement around the gas burner. Copper tubes are to be expanded into cast iron headers, onto which cast iron cover plates are bolted.

The heat exchanger shall be constructed in aluminium alloy with the front cover plate is cast iron with similar flow and return elbows. The mating surfaces are to be ground and a good seal made with gaskets. Each module is to be factory pressure tested to 11 bar. The module water inlet and outlet castings are to be 1 1/2" nominal bore and connected to the flow and return headers with flanges to BS 4504. The buoyancy of hot gases from the gas burner shall be overcome by using a slotted aluminium distribution screen arranged around the outside of the finned tubes. The slots shall have sufficient resistance to ensure even gas flows over the finned tubes.

#### Gas Burner

The natural gas burner shall be a perforated stainless steel cylinder producing a perfectly symmetrical gas flame. Gas and air in the correct proportions are to be pre-mixed in the burner fan which shall blow the gas/air mixture into the inside of the burner. A mixture distribution cone shall ensure an even flow through holes in the cylindrical burner. Ignition and burner performance shall be able to be observed through a sight glass mounted on the front plate.

#### Quality Assurance

The Boiler shall be manufactured under a Quality Assurance system to ISO 9001:2000

#### Manufacturers

Ideal Commercial Boilers Super Range High Efficiency boilers, Super Plus 6x50KW modules, there are 2 in total.

#### Commissioning

The boilers shall be tested, commissioned and set to work by a manufacturers approved agent in accordance with CIBSE commissioning code B and Gas ACOPS.

#### Contractors Responsibility

Prior to ordering, the contractor shall ascertain the adequacy of the flue and combustion air requirements and also replace the safety valves.

### 1.4 CCTV

#### Camera's

The existing 2 entrance hall cameras in the main entrance shall be replaced with 2no. day/night cameras with 16x Zoom Varifocal auto iris lens, internal mounting brackets, power supply units, 480 TV lines, auto focus, on screen display. CCD to be Sony Super HAD, camera to operate in colour down to 1.0 lux and monochrome to 0.01 lux with back light compensation. The camera with current cable fault shall be rewired back to the control position.

The existing 2 car park cameras in the main entrance shall be replaced with 2no. day/night cameras with 16x Zoom Varifocal auto iris lens, internal mounting brackets, power supply units, 480 TV lines, auto focus, on screen display. CCD to be Sony Super HAD, camera to operate in colour down to 1.0 lux and monochrome to 0.01 lux with back light compensation.

#### Control's

The Controls shall consist of an 8 way (to allow for expansion) digital video recorder (DVR) complete with the following features:

- MPRG4 format
- Graphical User Interface
- Instant Playback
- Multiple Outputs
- Watchdog
- 100 FPS
- Triplex Operation
- PTZ facility
- USB up/download
- DVD Burner
- 500GB storage to give 4 weeks recording at 15 FPS

#### Monitors

A 17 inch LCD monitor shall be provided at the front reception desk and at the Control position in the Security Office.

Existing redundant equipment shall be removed from site and disposed of in the correct manner.

The equipment shall be fully owned by the client and not subject to a lease or compulsory maintenance contract.

#### Quality Assurance

The Installation and manufacture of the equipment shall be subject to a Quality Assurance system to ISO 9001:2000

#### Supplier

Installation to be by Messrs Arrest 24:7 Security Ltd 0141 332 3666

#### Commissioning

The system shall be tested, commissioned and set to work by an SSAIB or NACOSS Gold approved installer in accordance with the relevant British Standards and Codes of Practice.

### 1.5 Chiller

#### Air Cooled water chillers

The unit is to be supplied with refrigerant and shall be factory tested. On-site installation therefore involves making connections to the mains power and water supplies.

Unit to be charged with R134a refrigerant.

Unit construction shall comply with European directives:

- Pressurized equipment directive (PED) 97/23/EC
- Machinery directive 98/37/EC, modified.
- Low voltage directive 73/23/EEC, modified
- Electromagnetic compatibility directive 89/336/EEC, modified, and the applicable recommendations of European standards:
- Machine safety: electrical equipment in machines, general regulations, EN 60204-1
- Electromagnetic emission EN 50081-2.
- Electromagnetic immunity EN 50082-2.

Unit shall be designed, manufactured and tested in a facility with a quality assurance system certified ISO 9001.

Refrigeration:

- Cooling capacity [kW] 519
- Total power input (unit) [kW] 138
- 100% EER @ Design Conditions [kW/kW] 3.76
- ESEER [kW/kW] 5.11

Evaporator:

- Water inlet temperature [°C] 12
- Water outlet temperature [°C] 6
- Glycol mixture [%] 0
- Water flow [l/s] 20.7
- Water pressure drop [kPa] 21.6

Condenser:

- Ambient temperature [°C] 28
- Condenser air volume [m<sup>3</sup>/s] 38.1
- No. Of fans 10

Compressor:

- Type Centrifugal oil-free inverter
- Number of compressors 2
- Refrigerant R134a
- Capacity steps Fully modulating

Electrical data :

- Power supply [V/f/Hz] 400/3/50
- Running current [A] 229
- Starting current [A] 135
- Compressor starting current (each) [A] 6

Full power sound:

- Sound power level [db(A)] 90
- Sound pressure level at 10 metres [db(A)] 61

Unit shall be capable of starting and running at full or part load at outdoor ambient temperatures from -10°C to 55°C.

- Nominal Energy Efficiency Ratio (EER) shall be >3.0 kW/kW and the unit rated Eurovent class A
- European Seasonal Energy Efficiency Ratio (ESEER) shall be >5.0 kW/kW

## UNIT COMPOSITION

Framework

Shall be constructed from galvanised steel assembled to form a rigid space frame for acceptance of galvanised steel electrolytically painted panels for total outdoor

protection. Internal compressor compartments fitted with thermo-acoustic insulation. Base frame to be manufactured from polyester-painted thick hot-galvanized sheet steel. The various components shall be arranged to reduce the overall dimensions of the unit to a minimum.

#### Centrifugal compressors

Two-stage centrifugal compressors fitted with radial dampers for inlet flow adjustment shall be fitted

Their permanent magnet synchronous motor shall have a built-in inverter to alter the speed of rotation of the impellers from 20,000 to 48,000 rpm (approx.). The compressor shall also feature a built-in soft-start device and batteries of capacitors for powering down the unit in the event of power failure. Magnetic levitation bearings with built-in shaft position control through proximity sensors shall be fitted. Manual reset motor thermal protection device to be integrated.

Screw compressors with oil flooded bearings are NOT acceptable.

#### Shell & Tube Flooded Evaporator

The evaporator is to be manufactured with steel shell and copper tubes. The shell shall be insulated with a closed-cell foamed polyethylene. The tubes are to be internally and externally grooved to improve heat exchange and mechanically expanded onto the tube plate ends. A dedicated droplet liquid separator system shall eliminate the possibility of liquid being drawn into the evaporator. The level of refrigerant inside the flooded evaporator is to be guaranteed by a dedicated level sensor and modulating electronic valve to maximise efficiency. An evaporator differential pressure switch is to be fitted as standard. Refrigerant side to be tested at 28.6 bar suitable for maximum working pressure of 20 bar. Water side to be tested at 14.3 bar suitable for maximum working pressure of 10 bar.

#### Condenser

Finned coil exchanger made from copper or aluminium tubes with aluminium fins mechanically bonded onto the copper tubes.

Condenser to be complete with sub-cooling circuit. Condenser fans shall be of the axial type with die cast aluminium blades directly driven by external rotor motor. Fans to be equipped with safety protection grilles.

Refrigerant side to be tested for maximum working pressure of 28 bar.

#### Refrigerant circuit

Main components of the refrigerant circuit shall comprise:

- -compressor discharge shut-off valves
- -compressor discharge non-return valve
- -liquid line solenoid valve
- -dryer filter with replaceable cartridge
- -refrigerant line sight glass with humidity indicator

- -electronic thermostatic valve
- -high pressure safety valve
- -low pressure safety valve
- -high pressure switches
- -high and low pressure gauges

#### Electric power and control panel

Electric power and control panel, built to EN 60204-1/EC 204-1 standards, complete with:

- control circuit transformer
- general door lock isolator
- power circuit with bar distribution system
- fuses for compressors
- terminals for cumulative alarm block (BCA)
- remote on/off terminals
- spring –type control circuit terminal board
- electronic controller
- filters
- forced air ventilation (only units provided with 6 or 8 compressors with line reactors installed inside the electrical panel)

The electrical section to comply with 98/37/EC (Machinery Directive), 89/336/CEE (EMC Directive); 73/23/CEE (Low Voltage Directive).

#### Optional Equipment to be provided:

- Anti Vibration Mounts
- Suction and Discharge Valves
- Electronic Exp Valves
- Flow Switch
- Evaporator Heater
- Low Ambient Kit
- Bac Net Interface card
- Suction Strainer
- Refrigerant Gas Leakage monitoring unit

### 1.6 Pumps, Boosters and Pressurisation Units

#### 1.6.1 Booster Sets:

Remove cold water booster set and scrap providing waste transfer certification. Install new unit including AV Coupling bellows as specified, including WRAS approved bellows including alterations to Plinth, controls and power supply. Commission and set unit to work, sterilise up services in accordance with BS6700. Work to be carried out outwith normal working hours.

Unit type, Ritmac Lowara GHV20/SV3303/2F55T

#### Circulating Pumps:

For the following pumps, replace with the variable speed driven units specified (including AV coupling bellows), including all necessary alterations to pipework, cabling, plinths and insulation. Set to work and commission; provide waste transfer certification for disposal of redundant units.

- CHW Main CT Pumps - Ritmac Lowara FCTS4 150-200/75
- CHW Fan Coil Unit Pumps - Ritmac Lowara FCTS4 125-200/40
- LTHW Primary Pumps - Ritmac Lowara FCTEH4 80-200/22
- LTHW CT Pumps – Ritmac Lowara FCTE4 65-200/15
- LTHW Fan Coil Unit Pumps (pumps to remain in place but converted to Hidrovar type as these are relatively new)
- LTHW VT Pumps - Ritmac Lowara FCTEH 40-125/11

Also replace the contactor and overload in the control panel for each pump to include mains, enable and fault for variable speed pumps including all necessary wiring.

### **Pressurisation Sets:**

Replace the following pressurisation sets, (excluding pressure vessels which are to remain) including all necessary alterations to pipework, controls and electrics to effect a complete working installation. Set to work and commission; provide waste transfer certification for disposal of redundant units.

- LTHW Set Ritmac Flexfiller 250D
- CHW set Ritmac Flexfiller 250D