SYSTEMS DESCRIPTION OF OPERATION

Scope of Mechanical and Electrical Services

The Mechanical, Electrical and Public Health services provided within the new Office building installation works can be summarised as follows:

- LTHW heating system, boiler plant, pumps & associated equipment
- HW heating to air handling unit and duct mounted heating coils
- Underfloor heating to the main entrance area
- Chilled water to duct mounted cooling coils
- Mechanical ventilation (supply and extract), including WC extract
- Packaged comfort cooling & heating VRF system and associated refrigerant pipework
- Cold Water potable and category 5 systems
- Domestic hot water systems
- Above ground sanitation drainage
- Natural gas services
- Building Management System (BMS)
- LV distribution
- Small power
- Data installation
- Fire detection and alarm system
- General and emergency lighting system
- Lighting Controls
- Containment System
- Testing & Commissioning

Mechanical Services

Incoming Services

A new 63mm MDPE incoming water supply is provided from the site boundary with a utilities water meter. The new water main is routed below ground from the external meter position to the ground floor boiler plantroom where it rises internally into the plantroom and a main isolation valve is provided.

A new 63mm medium pressure gas main connection has been made to the existing 250mm MDPE gas main in Sample Road and routed to a new external gas meter kiosk adjacent to the boiler plantroom. A new 180mm MDPE gas supply is provided from the gas meter kiosk which splits to a 100mm MDPE gas main to the boiler plantroom and 80mm MDPE gas main to the commercial

kitchen. Each gas main enters the building from an external low level riser and a main isolation valve is provided on entry to the building in each location.

Heating System

There are 2 no. Gas Fired Condensing Boilers located in the ground floor boiler plantroom which generate LTHW heating, generally serving ventilation system air handling unit coils tempering fresh air and the conference suite re-heat duct mounted coils. The heating system will generally operate at 80°C Flow and 60°C Return Temperature which is monitored by pipework immersion temperature sensors in the primary circuit.

A primary circuit twin pump set is installed to ensure constant flow through the boilers. A secondary constant temperature circuit is installed to distribute heating to the various air handling unit heating coils and duct mounted re-heat coils serving the conference suite.

System pressure is monitored by a heating pressurisation unit and this is interlocked with the boilers and pumps via the BMS system to shutdown main plant in the event of low/high system pressure or a general fault with the pressurisation unit.

An air and dirt separator is provided on the heating primary circuit, this needs to be checked and cleaned regularly to maintain system performance.

Pressure independent control valves (PICVs) are fitted to each heating coil and these ensure sufficient flow rate through each coil regardless of fluctuations in system pressure. The valves are controlled by the BMS controls system with the exception of the AHU 1 secondary heating coil which is controlled by the AHUs integral controls system.

Each air handling unit coil is provided for tempering fresh air only and is not intended to offset the full heating load of the building. The building is generally heated by VRF air conditioning systems, please refer to this section of the description for detailed information.

The main areas which are directly heated by the LTHW heating system are Conference Room One, Two and Three. Each Conference Room has an independent duct mounted re-heat coil. The heating demand and PICV controlling each coil is monitored and control by the BMS system. Please refer to the BMS section of the description for detailed information.

LTHW underfloor heating is provided to the main entrance area. The manifold and controls system for this are located in the Ground Floor Plantroom. The UFH is activated by a local room thermostat located in the entrance which is connected to a manifold wiring centre located in the Office Lounge. If a heating demand is detected a signal is sent from the wiring centre to the BMS system which activates the PICV and pumpset serving the UFH circuit.

Mechanical Ventilation Systems

AHU 1 – Main Supply and Extract

AHU 1 consists of supply and extract fans, filters, thermal wheel, LTHW heater battery and frost stat.

Air is distributed via a network of ductwork above ceiling and supplied into each area by ceiling and wall mounted diffusers. Air is extracted through extract and return air grilles within each area.

The air handling unit is controlled by the BMS system on a time schedule and operates at a variable speed once enabled under the dictates of the variable air volume system which is stand-alone to the BMS. Each main zone listed above is provided with a variable air volume (VAV) box or constant air volume (CAV) box on the supply and extract ventilation to each zone.

The VAV boxes are controlled by a master controls system which communicates with a module controller in each zone. Each module controls the supply and extract VAV boxes to suit the CO2 levels in each zone which area measured by duct mounted return air CO2 sensors.

The master controller monitors the air volume required at each VAV box and sends a demand signal to the BMS system which controls the speed output of the air handling unit.

The AHU has a fixed supply air temperature setpoint of 20°C (user adjustable). A supply air temperature sensor is also provided this is to control the supply air between a min setpoint of 18°C (user adjustable) and max setpoint of 22°C (user adjustable)

Local Extract Fans

There are 4 no. local dirty extract fans which are controlled by the BMS and extract air from WC and Cleaners areas under time schedule control as listed below:

- TEF/01 – Main WC Area
- TEF/02 – Office WC Area
- TEF/03 – Kitchen & Staff WC Area

VRF Air Conditioning System

The variable refrigerant flow (VRF) air conditioning system provides heating and cooling to all areas of the building with exception of the Main Entrance.

Heating and/or cooling is provided by a 3-pipe VRF network of refrigerant pipework split into a North and South system. Each system has external condenser units and a combination of ceiling void mounted and wall mounted indoor units. Warm or cool is supplied into each area from the ceiling void mounted units by supply air diffusers and return air grilles are provided to circulate air back to the ceiling void.

The VRF system control is stand-alone from the BMS system. The VRF time scheduling and control set-points are adjustable from the VRF central controller which is located in the main ventilation plantroom or via a web browser interface which can be accessed from any computer connected to the building data network. Certain areas of the building are provided with local wall mounted remote controllers to control the VRF indoor units within that space. Generally the room temperature is controlled via wall mounted temperature sensors in public use areas.

The BMS system monitors the VRF for a common fault condition from the central controller.

Domestic Hot and Cold Water Systems

From the incoming mains cold water position in the boiler plant room, a main isolation valve is provided and mains cold water is distributed to a main cold water break tank within the plantroom. Potable cold water is distributed throughout the building by the mains cold water break tank and booster set.

A second cold water booster set and break tank is provided to supply Fluid Catergory 5 compliant water to irrigation supplies and pressurisation units. Each cold water booster set is powered from the BMS control panel and monitored by the BMS for fault conditions.

2 no. natural gas fired condensing water heaters generate hot water for the various the outlets throughout the building. A DHWS Secondary Pump circulates water from the DHWS Heaters to the hot water outlets and this is all controlled by a BMS time schedule.

Above Ground Drainage Systems

A uPVC above ground drainage system is provided to all sanitary accommodation. The above ground drainage connects sanitary appliances to drain sockets located adjacent to all sanitary ware appliances or SVP positions.

The above ground drainage system is vented to atmosphere and incorporates automatic air admittance valves to facilitate full venting and drainage.

The drainage system has been designed and will be installed to achieve the following:

- Prevent the transmission of foul air into the building.
- Minimise the frequency of blockages and provide adequate pipe access to enable the effective clearance of any blockage.
- Pipework will be kept as short as possible, with the fewest number of bends, and installed at the adequate gradient.

Natural Gas Services

From the incoming gas position in the boiler plant room, a main isolation valve is provided and natural gas pipework is distributed to serve 2 no. heating boilers and 2 no. gas fired water heaters Each appliance is provided with local isolation valves.

An emergency gas solenoid valve is located on the incoming gas main as it enters the boiler plantroom. It is energised by the control panel and interlocked with the thermal links over each gas appliance as listed above, the fire alarm system and the emergency knock off button at the boiler plantroom entrance.

If any one of the safety interlocks are activated the gas valve will close. The valve cannot be re-opened until the safety interlock is reinstated. Once reinstated, the gas valve will open automatically.

From the incoming gas position in the kitchen area, a main isolation valve is provided and natural gas pipework is distributed through the kitchen to serve the gas frying range. An emergency gas solenoid valve is provided which is interfaced with the kitchen gas guard panel located on the wall near the frying range.

To activate gas to the frying range, the keyswitch on the panel needs to be operated and gas proving to ensure no leaks are present. For the gas solenoid to open, the gas guard panel must also detect that there is active supply and extract ventilation from the kitchen air handing plant. The gas solenoid valve will also close if a fire alarm is activated or if the emergency stop button on the gas guard panel is pressed.

The natural gas services are also sub-metered as follows and are monitored by the BMS System:

- GM1 – External Utility Gas Meter c/w Pulse Output
- GM2 – Kitchen Gas Sub-Meter c/w Pulse Output
- GM3 – Boiler Plant Gas Supply Sub-Meter c/w Pulse Output
- GM4 – Hot Water Heater Gas Supply Sub-Meter

Building Management System

The project is provided with a building management system which provides control and monitoring of all major mechanical services plant. There are 3 no. new control panels (MCP) installed that contain Trend intelligent controllers.

The Trend Building Management System (BMS) has been installed to provide time and temperature control functionality for the mechanical services equipment installed on the project.

The operation of the control panel's is fully automatic, and functions as detailed below. Each of the facia mounted switches and indicating lamps being clearly marked as to its function and equipment controlled.

The panels contain a door interlocked main isolator, all motor starters, thermal overloads, control circuit transformers, MCBs, relays and outgoing terminals with all necessary selector switches and indicator lamps mounted on the panel facia.

Network Format

Controllers installed on this project are the Trend IQ4 range which use Ethernet and TCP/IP networking technologies. The controllers are connected via the client's site IT network and to a front-end new Trend 963 graphics supervisor PC installed within the Comms Room.

963 is a graphical, real time, user interface for the building control system. It enables the user to monitor plant or building services and make changes to the way the building is controlled from a graphical display. All pages and actions are accessible using a mouse. The security system ensures that the user is only presented with information and functions that are relative to their authority or task.

The plant controlled and/or monitored by the BMS can be summarised as follows:

MCP01 – Located in Boiler Plantroom (Ground Floor Level)

The control panel contains the following building management control equipment: -

Backplate mounted trend IQ4E/96/XNC controller (LAN 1 address 21) with associated input/output modules.

A door mounted trend IQVIEW8 (touch screen display) which enables the user to view and adjust controller parameters across the Trend BMS Network.

Temperature set points, software switches, and plant faults are monitored and can be adjusted.

IQ4E/96/XNC controller address settings are as follows: -

IP address	192.168.221.11
Subnet mask	255.255.255.0
VCNC	10051

The following plant and equipment are controlled or monitored by MCP01:

- 2 no. Heating Boilers, Natural Gas Fired Condensing
- 1 no. Heating System Pressurisation Unit
- 1 no. Boiler Primary Circuit Twin Pump
- 1 no. Secondary Heating Circuit Constant Temperature Twin Pump
- 2 no. Domestic Hot Water Heaters, Natural Gas Fired Condensing
- 1 no. Domestic Hot Water Secondary Return Single Pump
- 1 no. Chilled Water Circuit Twin Pump and Control Valves
- 1 no. Underfloor Heating Manifold Twin Pump

- 1 no. Underfloor Heating Circuit Pressurisation Unit
- 1 no. Mains Cold Water Booster Set
- 1 no. Cat 5 Cold Water Booster Set
- 1 no. Boiler Plantroom Gas Solenoid Valve
- 1 no. External Gas Meter
- 1 no. External Water Meter
- 4 no. Gas Sub-Meters
- 1 no. Air Handing Unit (AHU 1) – Main Supply and Extract
- 4 no. Toilet Extract Fans (TEF/01 - TEF/04)