THIS FOLDER WAS CHECKED BY ARUP ON

21.3.03

The checking process was to ensure that 3 identical sets of each Volume of the Operating and Maintenance Manuals existed

SYNCHRONISED SYSTEMS

SYNCHRONISED SYSTEMS
HORTON ROAD • COLNBROOK
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REF.DJF/S9805716/JPD

24 January 2000

Mace Limited
Wool House Garden
Carlton Gardens
St. James's
London
SW1 5AD

For the attention of Mr. M. Barford

Dear Sirs,

RE: 5-7 Carlton Gardens

Please find enclosed the following documents:-

1/ One final issue copy of our Commercial Block Operating and Maintenance Manual.

2/ A complete set of Record Drawings for both areas.

3/ A CD which includes the Commercial O & M, Residential O & M, Record Drawings and BMS Points Schedules.

If you have any queries regarding the above would you please contact the undersigned.

Yours faithfully,
For and on behalf of Synchronised Systems

Jon Dell
Design Engineer

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5-7 CARLTON GARDENS
LONDON SW1

OPERATING & MAINTENANCE INSTRUCTIONS
for the
BMS

VOLUME 2
2.1 – Sections A-F

Collated By :
Commissioning Management Ltd
5, St Peters Court
Colchester
Essex
C01 1WD

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Fax : 01206 761932

MASTER INDEX

Volume 1 Mechanical Services

MASTER INDEX – cont.

Volume 2 BMS

Volume 3 Electrical Services

MASTER INDEX – cont.

MASTER INDEX – cont.

Volume 5 Building Fabric – cont.

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MODIFICATION INFORMATION

Modifications and authorised changes which may affect the safety, reliability, operation or maintenance of a system or any of its components are to be recorded and registered. Information on permitted plant or system modifications allowed for by manufacturers or system designers should be included for each system.

All modifications and changes must be recorded as they occur.

Furthermore it is essential that a procedure is devised and incorporated to ensure that all modifications are noted in every copy of the manual, wherever it is located.

RECORD OF MODIFICATIONS

DATE	DETAIL	AUTHORITY	SIGNATURE

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A

A.1 GENERAL NOTES

This manual has been prepared to provide a guide to the operation and maintenance of the Building Services installed in this Development.

It details:

a) What services and plant are installed.

b) What the systems provide.

c) How to operate the systems.

d) What planned maintenance is recommended.

e) How to deal with emergencies.

f) How to avoid risks to Health and Safety.

g) How to monitor the performance of the systems for the purpose of energy management.

This manual is not intended to replace the services of fully qualified Engineers.

It is recommended that any persons employed as Maintenance Engineers immediately become familiar with the installation and are available at all times to carry out regular inspections, maintenance and emergency repairs.

It is most important that this manual is read in conjunction with:

1) " As Fitted" Drawings.

2) Schematic diagrams and charts.

3) Specific Manufacturers Literature.

The equipment and materials supplied under this contract are safe and no risk to health as installed, so long as the instructions that follow and those outlined in the suppliers literature contained in this manual are followed and an experienced Maintenance Engineer is engaged to effect any repairs.

Format

All O&M manuals are provided in hard copy and software format. Software versions are provided on 1.44mb diskettes in Microsoft Word V6.0.

A.2 HEALTH AND SAFETY AT WORK

There are provisions in connection with Safety, Health and Welfare which are legal requirements; in addition there are many official recommendations. For full details of these, reference should be made to the appropriate official publications. The following paragraphs refer briefly to the more common requirements.

It is the duty of every employer:

a) to ensure, so far as is reasonably practicable, the health, safety and welfare at work not only of all his employees but of other people who use his premises or are affected by his undertaking.

b) to provide the information necessary for (a) above.

It is the duty of every employee while at work:

a) to take reasonable care for the health and safety of himself and of other people who may be affected by his acts or omissions at work.

b) to co-operate with his employer or any other person so far as is necessary for the provisions of the various As relevant Acts to be complied with.

A.2.1 Permit to Work System

A 'permit to work' system must be adopted to meet and satisfy the legal requirements of the present legislation.

The 'permit to work' system should incorporate the following:-

a) To give authority to maintenance staff to commence inspection of plant, or work on plant.

b) To explain and outline the approach required to carry out the work in a way that no personnel or plant hazard to the working environment is created.

c) The system should be devised so that maintenance may be carried out safely and that starting up or running of plant presents no environmental hazard.

d) Co-ordination of staff requirements in relation to maintenance procedures and operations to eliminate exposure of the workforce to any hazard.

e) Correct shutting down of systems must be observed and no electrical work on equipment where removal of guards or housings has taken place must be undertaken without satisfactory clearance that the plant is now safe for work to proceed.

f) Members of the maintenance staff must only carry out work within their discipline and job description.

g) Where it is necessary to provide staging scaffolding, towers and ladders to examine or carry out replacement of components then these must comply in all respects with the latest legislation.

All safety precautions are to be observed when using replacement products. All electric circuit diagrams, and manufacturers spares lists must be checked against the existing equipment to determine it is the correct arrangement or equipment for the specific application.

Any item used must comply with the correct British Standard specification and where tests are carried out on these, they must be in compliance with relevant British Standard Specifications or Codes of Practice.

Starting up of all plant must be acted upon in conjunction with plant manufacturer's commissioning and starting up manuals, so that the correct setting of switches, valves and their sequence of operations is correct for each individual piece of equipment.

CAUTION - Remotely Controlled Plant

Do **NOT** put hands or objects on any item of stationary rotating machinery as the equipment may start automatically and cause injury or damage.

A.2.2 Warning and Safety Notices

At all times warning and safety notices must be maintained and properly displayed and worded to give clear instructions.

Notices covering First Aid and Resuscitation from Electric Shock must be displayed in all plant-rooms.

Proper fire precautions must be observed within the plant-rooms and building.

Smoking will not be allowed in any plant-rooms or service space.

Notices must be displayed stating **"NO SMOKING"** and **"SMOKING PROHIBITED IN THIS AREA"**.

All fire fighting equipment must be clearly marked and available for use.

A.2.3 Fire Protection/Alarms

Fire fighting equipment, hose reels, sprinkler systems, etc. must be provided, regularly tested, maintained and kept readily available.

Fire alarm systems must be regularly checked, and kept in working order.

Care must be taken, and adequate protection provided, to prevent fire when welding or carrying out similar operations involving the application of heat. Arc welding demands protective screens. Precautions against explosions are laid down for working on tanks or containers which have held explosive or flammable substances.

All extinguishers must be periodically examined and contents renewed as required.

Each extinguisher should be numbered and a log kept of inspections and action.

A.2.4 Escape Routes

Periodic inspection of all escape routes and exits should be made to confirm that doors open freely and routes are clear of obstructions.

Should oil be spilt on bases or floors the area must be thoroughly cleaned and sanded.

A.2.5 Identification Labels

All items of plant and equipment are labelled. Refer to description of the installation (section B), description of operation (section D) plant schedules (section C) and valve schedule for functions.

A.2.6 Lighting

In all plant-rooms and service areas lighting must be maintained at a high level to enable inspections to be carried out and prevent accidents due to badly lit areas.

A.2.7 Portable Tools and Hand Lamps

Where power operated hand held tools or hand lamps are used these items together with their power supply must conform to the regulations applying to the use of this type of apparatus.

A.2.8 Plant-rooms

A high degree of cleanliness both of rotating machinery and static equipment is of the utmost importance. Floors and machinery must be protected from spilt lubricants. Loose materials, containers and papers must not be allowed to accumulate.

A.2.9 Drains and Sumps

All drains must be cleared of silt or any refuse to ensure that these are free and unobstructed at all times. Sumps must be inspected, drained regularly and cleaned.

A.2.10 Keys

Access to all plant-rooms and equipment contained there in must be controlled and restricted to authorised personnel only.

A.2.11 Drive Guards and Housings

It is important that after maintenance has been carried out on any piece of equipment on which drive guards or housings have been removed, that these are replaced immediately the work has been completed.

Ensure that at all times, when guards and housings are removed, that the electrical supply to the unit is isolated and fuses removed.

Starting up of plant, replacing of guards and housings, any further disconnection and restoring of plant into full service is carried out by authorised personnel only.

Caution - Remotely Controlled Plant

Do **NOT** put hands or objects on any item of stationary rotating machinery as the equipment may start automatically and cause injury or damage.

A.2.12 Pollution

Anyone in control of industrial or commercial premises must render inoffensive any potentially harmful emissions into the atmosphere.

A.2.13 Protective Equipment

Where appropriate to the work, protective equipment (e.g. goggles, screens, respirators, protective clothing, safety belts) must be provided and used.

A.2.14 Dangerous Substances

Battery acid, water treatment, and all other chemicals must be stored and handled carefully. They are poisonous and can damage the skin and particularly the eyes.

Adequate ventilation must be provided. Special precautions must be taken in atmosphere where there is steam, smoke, asbestos or other unhealthy or dangerous contaminants, or in confined spaces.

Refrigerant gas should not be inhaled and must never be exposed to a naked flame.

A.2.15 First Aid

First Aid boxes or cupboards of the prescribed standard, must be provided in accessible positions, and kept clean and in good repair. The minimum quantity and quality of dressings etc. has been laid down according to the number of persons employed. Where it is required by the Regulations, a responsible and readily available person, trained in First Aid treatment, must be named, and placed in charge of the equipment during working hours.

A.2.16 Bacteria

The tanks of cooling towers and the drain/drip trays from all cooling coils should be examined weekly for the presence of slime or algae. If detected, such slime or algae must be completely removed by vigorous scrubbing with a solution of household bleach (sodium hypochlorite). Domestic cold water storage tanks and the ponds of cooling towers, and any open recirculatory spray water systems, should be drained down and left empty if they are to be out of use for a long period of time.

Every six months all such tanks and ponds should be emptied, cleaned, disinfected with bleach, flushed clear of bleach and refilled with fresh mains water.

For details, see separate instructions for the particular plant item.

Full advice on Biocide treatment of cooling towers and other recirculatory systems should be sought from the Water Treatment Specialist.

All water in HWS and CWS systems should be kept above 65^{o}C or below 20^{o}C to lessen the possibility of harmful bacteria breeding in the systems: this is particularly important for storage tanks and other parts of the system (e.g. dead legs) where the water may be stagnant for considerable periods.

A.3 EMERGENCY INFORMATION

1. Names, addresses, telephone numbers, fax numbers etc. of appropriate contacts in the event of fire, theft, burglary, gas leak, water leak, electricity failure etc.

A.4 CONTRACTUAL AND LEGAL DETAILS

1. *Information on all guarantees or warrantees affecting components, systems and plant items, together with expiry dates and names, addresses and telephone numbers of relevant contacts.*

B

B THE INSTALLATION

B.1 PURPOSE OF THE INSTALLATION

The primary function of the Building Energy Management System (BEMS) installation is to monitor and maintain the internal environmental conditions of the building via the building services under its control.

Under normal operation the building services are controlled by optimiser based control loops, to ensure the desired environmental conditions are achieved for start and during the occupancy period.

The BMS will perform the following functions :-

1. To control plant operating times.
2. To communicate with the fire system.
3. To monitor external and internal environmental conditions and optimise energy utilisation.
4. To indicate system / equipment failure.
5. To monitor and indicate specified alarms.
6. To sequence use of run and standby plant.
7. To maintain environmental conditions within the building.
8. To provide a user-friendly interface with the building services control strategies.
9. To allow the Building Facilities Manager to view the status of all plant and environmental conditions in areas under BMS control.
10. To allow the Building Facilities Manager to revise plant operating times, plant sequencing etc.

The BMS has a 'head end' computer located in the Basement Security Room. The computer will be the focal point of the BMS.

It will display graphics pages complete with relevant information for each individual plant, so that the user can easily view any equipment.

The BMS can also function as a maintenance early warning tool. The computer will make the user aware of any alarms, or failures as they are occur, so that maintenance can be actioned swiftly.

B.2 Environmental Design Conditions

External

Winter	-4°C Saturated minimum
Summer	28°Cdb - 20°Cwb maximum

Internal

Offices	Summer 22°C ± 1°C	Winter 21°C± 1.5°C
Entrances	Summer 22°C ± 1°C	Winter 21°C± 1.5°C
Lift Motor Rm	Summer 34°C Max	Winter 5°C Min
Toilets	Summer Uncontrolled	Winter 20°C± 1.5°C
Stairs	Summer Uncontrolled	Winter 18°C heating only.

The following should be noted,

Under "The Fuel & Electricity (Heating Control Amendment) Order 1980, Statutory Instrument No. 1013", it may be necessary to set the winter heating controls at 19°C (66.2°F).

The summer heat gain calculations assume the use of interior blinds on all windows except in the North face.

Office areas relative humidity is limited to 60% in summer and in winter will be a function of the outside conditions as no artificial humidification is provided. Space and electrical supply provision have been allowed for future tenant enhancement.

Toilet rooms are provided with mechanical supply and extract ventilation.

B.3 DESCRIPTION OF SYSTEMS

B.3.1 AHU01 (East Office Ventilation) - System 1

GENERAL

1 The air handling unit supplies air to, and extracts air from, the east side of the office areas from the lower ground to the fifth floor. Air is supplied to the offices via the backs of the fan coil units on each floor.

2 The supply side of the AHU consists of a variable speed supply fan, an inlet air damper, a frost coil, a panel filter, a bag filter, an air-to-air recuperator with face and bypass dampers, a cooler battery and a heater battery. There is space in the AHU for the future addition of a steam humidifier.

3 The extract side of the AHU consists of a variable speed extract fan, the exhaust part of the air-to-air recuperator, and an exhaust isolation damper.

4 There are motorised smoke dampers on both the supply and extract branches to the office floors from the main supply and extract risers. These are controlled both by the BEMS for floor isolation purposes, and also by the fire detection system. (Refer to systems 30 to 36 for more details).

5 In a fire condition, the extract section of the AHU is isolated via a smoke damper; and by opening up another smoke damper, the east staircase pressurisation relief fans (system 20) are connected to the east office extract riser.

6 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

AHU02 (West Office Ventilation) - System 2

GENERAL

7 The air handling unit supplies air to, and extracts air from, the west side of the office areas from the lower ground to the fifth floor. Air is supplied to the offices via the backs of the fan coil units on each floor.

8 The supply side of the AHU consists of a variable speed supply fan, an inlet air damper, a frost coil, a panel filter, a bag filter, an air-to-air recuperator with face and bypass dampers, a cooler battery and a heater battery. There is space in the AHU for the future addition of a steam humidifier.

9 The extract side of the AHU consists of a variable speed extract fan, the exhaust part of the air-to-air recuperator, and an exhaust isolation damper.

10 There are motorised smoke dampers on both the supply and extract branches to the office floors from the main supply and extract risers. These are controlled both by the BMS for floor isolation purposes, and also by the fire detection system. (Refer to systems 37 to 43 for more details).

11 In a fire condition, the extract section of the AHU is isolated via a smoke damper; and by opening up another smoke damper, the west staircase pressurisation relief fans (system 21) are connected to the west office extract riser.

12 Refer to the mechanical services drawings for equipment locations and the AHU schematicsGeneral

AHU03 (Office Core Lobby & Toilet Ventilation) - System 3

GENERAL

13 The air handling unit supplies air to the office toilets from the lower ground to the fifth floors, plantrooms and other miscellaneous areas. The AHU extracts air from the toilets only.

14 The supply side of the AHU consists of a constant speed supply fan, an inlet air damper, a frost coil, a panel filter, a bag filter, an air-to-air recuperator with face and bypass dampers and a heater battery. There is space in the AHU for the future addition of a steam humidifier.

15 The extract side of the AHU consists of duty/standby constant speed extract fans with associated backflap dampers, the exhaust part of the air-to-air recuperator, and an exhaust isolation damper.

16 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Basement Staffroom, Mailroom & Lift Motor Room Ventilation - System 4

GENERAL

17 Air is supplied to the basement staffroom, mailroom and lift motor rooms by supply fan set SF02 consisting of twin constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper. Associated with SF02 is a panel filter and LTHW heater battery.

18 Air is extracted from the basement staffroom, mailroom and two lift motor rooms by extract fan set EXH06 consisting of twin 2-speed extract fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

19 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Basement WCs and Refuse Room Extract Fans - System 5

GENERAL

20 The Basement WCs and the refuse room are ventilated by extract fan set EXH07, consisting of two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

21 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Car Park Ventilation & Smoke Fans - System 6

GENERAL

22 The Car Park is ventilated by extract fan set EXH01, consisting of two 2-speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

23 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

BMS/Security Room Ventilation - System 7

GENERAL

24 Make-up air is supplied to the BEMS/Security room by supply fan SF03, consisting of a panel filter, electric heater battery and a constant speed fan. The room is temperature controlled by a dedicated split AC unit which is fed from a local distribution board.

25 Air is extracted from the WC associated with the BEMS/Security room and the cleaner's room by a twin axial fan packaged unit EXH08 which operates in a duty/standby manner under the dictates of its own controls.

26 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Basement Plant West Extract - System 8

GENERAL

27 The boiler room, sprinkler room, CWS tank room, HVAC plantroom and workshop are ventilated by extract fan set EXH02, consisting of twin 2-speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

28 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Basement Plant East Extract - System 9

GENERAL

29 The basement plantroom, LV switchroom and lift motor rooms 1, 2, 3 & 6 are ventilated by extract fan set EXH03, consisting of twin 2-speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

30 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Residential Staircase Pressurisation Fans - System 10

GENERAL

31 The residential staircase pressurisation fans are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

32 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Office Staircase Pressurisation Fans - System 11

GENERAL

33 The office staircase pressurisation fans are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

34 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Fire Fighting Staircase Pressurisation Fans - System 12

GENERAL

35 The firefighting staircase pressurisation fans are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

36 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Workshop Ventilation - System 13

GENERAL

37 Air is supplied to the basement workshop by constant speed supply fan SF04, and is extracted by EXH02 (refer to System 8).

38 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Boiler Room Combustion Air - System 14

GENERAL

39 Combustion air is supplied to the boiler room by supply fan set SF01, consisting of twin constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper. Associated with SF01 is an electric heater battery, panel filter and LTHW heater battery.

40 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

East Office Pressurisation Relief Fans - System 20

GENERAL

41 In a fire condition, air supplied to the fire fighting staircase by its pressurisation fan is extracted through the office floors via the east office pressurisation relief fans. These are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

42 The fans extract air through the East office extract riser in parallel with the East office extract AHU. There are two motorised smoke dampers associated with these extract systems which work in an opposed manner for isolation

purposes. One isolates the pressurisation relief fans when the AHU is running normally, the other isolates the AHU when the relief fans are running in a fire mode.

43 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

West Office Pressurisation Relief Fans - System 21

GENERAL

44 In a fire condition, air supplied to the office and residential staircases by their pressurisation fans is extracted through the office floors via the West office pressurisation relief fans. These are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

45 The fans extract air through the West office extract riser in parallel with the West office extract AHU. There are two motorised smoke dampers associated with these extract systems which work in an opposed manner for isolation purposes. One isolates the pressurisation relief fans when the AHU is running normally, the other isolates the AHU when the relief fans are running in a fire mode.

46 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Lower Ground Floor (East) Controls - System 30

GENERAL

47 The Lower Ground Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 20 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

48 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Ground Floor (North) Controls - System 31

GENERAL

49 The ground floor is different to the other office floors in that it is split North and South, as oposed to East and West.

50 The Ground Floor (North) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 18 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

51 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

First Floor (East) Controls - System 32

GENERAL

52 The First Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 17 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

53 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Second Floor (East) Controls - System 33

GENERAL

54 The Second Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

55 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Third Floor (East) Controls - System 34

GENERAL

56 The Third Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

57 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Fourth Floor (East) Controls - System 35

GENERAL

58 The Fourth Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

59 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Fifth Floor (East) Controls - System 36

GENERAL

60 The Fifth Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 11 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

61 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Lower Ground Floor (West) Controls - System 37

GENERAL

62 The Lower Ground Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 20 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

63 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Ground Floor (South) Controls - System 38

GENERAL

64 The ground floor is different to the other office floors in that it is split North and South, as oposed to East and West.

65 The Ground Floor (South) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 17 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

66 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

First Floor (West) Controls - System 39

GENERAL

67 The First Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 18 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

68 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Second Floor (West) Controls - System 40

GENERAL

69 The Second Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

70 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Third Floor (West) Controls - System 41

GENERAL

71 The Third Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

72 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Fourth Floor (West) Controls - System 42

GENERAL

73 The Fourth Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

74 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Fifth Floor (West) Controls - System 43

GENERAL

75 The Fifth Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied

via the back of 11 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

76 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Primary Boiler Plant - System 100

GENERAL

77 The primary heating circuit is a staged constant volume system and consists of two banks of modular gas fired boilers, with four modules in each bank, and two-speed duty/standby primary circulating pumps. Each bank of boilers is controlled by its own sequencer. Associated with the boiler plant primary circuit is a packaged pressurisation unit. Combustion air is provided by fan set SF01 (refer to System 14).

78 The secondary heating system consists of two constant volume and two compensated circuits. Refer to system 101, 102, 103 and 104 narratives for details.

79 Refer to the mechanical services drawings for equipment locations and the schematics.

FCU Secondary LTHW Circuit - System 101

GENERAL

80 The FCU secondary heating circuit is a variable temperature, constant volume circuit and consists of a duty/standby constant speed pump set in a compensated circuit arrangement with an associated three-port mixing valve.

81 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

AHU Secondary LTHW Circuit - System 102

GENERAL

82 The AHU secondary heating circuit is a constant temperature, constant volume circuit and consists of a duty/standby constant speed pump set serving the AHU heater batteries.

83 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

DHWS Calorifier LTHW Circuit - System 103

GENERAL

84 The DHWS calorifier LTHW circuit is a constant temperature, constant volume circuit and consists of a duty/standby constant speed twin-head pump set serving two storage calorifiers. There is no secondary side pumping.

85 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

Radiator & Landlord's LTHW Circuit - System 104

GENERAL

86 The radiator and landlord's LTHW circuit is a variable temperature, constant volume circuit and consists of a duty/standby constant speed twin-head pump set in a compensated circuit arrangement with an associated three-port mixing valve. The circuit serves radiators fitted with TRVs, and the basement AHU heater batteries serving the landlord's areas. Because the variable volume part of the circuit, the radiators, is small compared to the constant volume heater batteries, there is no pressure control or flow bypass valve required.

87 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

Primary Chilled Water Plant - System 200

GENERAL

88 The chilled water plant consists of two equal sized water cooled chillers, a duty/standby primary circuit circulating pump set, a duty/standby condenser circuit circulating pump set, three dry air coolers and two packaged pressurisation units, one for the chilled water circuit and one for the condenser water circuit. The condenser water circuit contains glycol.

89 The secondary cooling system consists of two constant volume circuits. One circuit serves the FCUs, and one serves the AHUs. Refer to the system 201 and 202 narratives for details.

90 The chillers and the dry air coolers are controlled by the chiller manufacturer's own sequencer package which is enabled to run via a command from the BMS.

91 Refer to the mechanical services drawings for equipment locations and the CHW schematics.

FCU Secondary CHW Circuit - System 201

GENERAL

92 The FCU secondary chilled water circuit is a constant temperature, constant volume circuit and consists of a duty/standby constant speed pump set serving the FCU cooler batteries.

93 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

AHU Secondary CHW Circuit - System 202

GENERAL

94 The AHU secondary cooling circuit is a constant temperature, constant volume circuit and consists of a duty/standby constant speed pump set serving the AHU cooler batteries.

95 Refer to the mechanical services drawings for equipment locations and the chiller circuit schematic.

Residential Controls - Systems 300 to 305

GENERAL

96 There are 6 residences located on the sixth and seventh floors of the building. Each residence has its own small plantroom boiler containing a boiler with an associated primary circuit and pump, an HWS secondary circuit with an HWS cylinder and pump, a radiator/towel rail secondary circuit and pump, and a bathroom underfloor heating secondary circuit. The underfloor heating secondary circuit serves a packaged tertiary circuit complete with three-port mixing valve and controls to achieve a reduced underfloor flow temperature. An extract fan ventilates the boiler plantroom.

97 For each residence, with the exception of the kitchens and the bathrooms, all the rooms are temperature controlled via a ceiling mounted VRV heat pump system, with the condenser units located on the roof. Rooms with VRV units are supplied with tempered fresh air when their associated VRV unit runs by a number of fans, each with their own electric heater battery.

98 All six residences are controlled in exactly the same manner, with room configurations being the only differences. The following description is therefore typical for all residences.

Public Health Monitoring - System 400

GENERAL

99 The BEMS shall monitor the public health equipment points listed in the equipment schedules for status and alarms.

Electrical Monitoring - System 500

GENERAL

100 The BEMS shall monitor the electrical equipment points listed in the equipment schedules for status and alarms.

101 The terminals for BEMS indications from the two electrical switchboards monitored by the BEMS will be located in a separate marshalling chamber for each switchboard.

102 Monitoring equipment associated with system 500 shall be housed in Control Panel MCC B/1.

Fire Operation - System 999

GENERAL

103 The BEMS interface to the fire detection system shall be via a number of FIOUs (Fire Interface Output Units) provided locally to each MCC or MCP Control Panels. Each FIOU provides a volt-free contact which represents an action to be taken in the event of a fire as detailed below.

104 All stopping and starting of plant shall be via hardwiring within the MCC/MCP Control Panel, not through software, though software should either mimic the hardwired action or disable failure alarms and failure flags to prevent the plant generating secondary alarms and allow the plant to restart automatically on a return to normal.

105 The only software action allowed in a fire situation is for the changing of duty in the case of fan failure for fans where there is both a normal and fire mode of operation (as opposed to dedicated fire mode fans).

Where stated in the narratives, the fire system shall monitor the status and availability of fans or smoke damper positions via FIMUs (Fire Interface Monitoring Units) from volt-free contacts provided within the associated BEMS control panel.

C

REF.JHW/S98057l2/jhw

13 February 2000

Benchmark
Wool House Garden
Carlton Gardens
St. James's
London
SW1 5AD

For the attention of Mr. B. O'Leary

Dear Sirs,

RE: 5-7 Carlton Gardens

As requested by Mr. M. Barford, of Mace Ltd, please find attached one copy of the network schematic, drawing no. S98057-FCUNW-01 for the Seachange Fan Coil Unit Controls for the above project.

A schedule of the Fan Coil Unit Numbers relating to the Seachange Address Nos. is enclosed.

Also enclosed is a copy of the individual Fan Coil Unit wiring diagram, drawing no. S98057-220, together with Seachange data Sheets for the Fan Coil Unit Controllers, Zone Controllers, Power Supplies, and Actuator Controllers.

Yours faithfully,
For and on behalf of Synchronised Systems

J. H. Wetherell
Technical Director

c.c. Mr. M. Barford – Mace Limited

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5 - 7 Carlton Gardens Fan Coil Unit Address Schedule

11/2/00

LOWER GROUND FLOOR EAST		
UNIT REF		SEACHANGE ADDRESS
1		27
2		26
3		25
4		28
5		24
6		23
7		20
8		18
9		17
10		14
11		16
12		19
13		15
14		11
15		13
16		12
17		10
18		29
19		9
20		8

LOWER GROUND FLOOR WEST		
UNIT REF		SEACHANGE ADDRESS
21		25
22		26
23		24
24		21
25		22
26		18
27		23
28		19
29		16
30		17
31		20
32		15
33		14
34		12
35		13
36		10
37		11
38		9
39		8
40		27

GROUND FLOOR SOUTH/EAST		
UNIT REF		SEACHANGE ADDRESS
17		50
18		49
19		51
20		48
21		52
22		53
23		54
24		47
25		55
26		61
27		56
28		62
29		57
30		21
31		60
32		59
33		65
34		63
35		64

GROUND FLOOR NORTH/WEST		
UNIT REF		SEACHANGE ADDRESS
1		87
2		86
3		38
4		41
5		37
6		43
7		36
8		42
9		35
10		28
11		85
12		84
13		34
14		82
15		29
16		158

5 - 7 Carlton Gardens Fan Coil Unit Address Schedule

11/2/00

1ST FLOOR EAST		
UNIT REF		SEACHANGE ADDRESS
1		43
2		39
3		38
4		40
5		42
6		41
7		36
8		37
9		44
10		45
11		34
12		33
13		35
14		46
15		32
16		31
17		30

1ST FLOOR WEST		
UNIT REF		SEACHANGE ADDRESS
18		44
19		43
20		47
21		45
22		41
23		157
24		39
25		37
26		38
27		36
28		35
29		32
30		46
31		33
32		45
33		30
34		48
35		6

2ND FLOOR EAST		
UNIT REF		SEACHANGE ADDRESS
1		66
2		67
3		68
4		69
5		71
6		70
7		72
8		131
9		74
10		73
11		132
12		77
13		78
14		79
15		80
16		81
17		82
18		83
19		7

2ND FLOOR WEST		
UNIT REF		SEACHANGE ADDRESS
20		78
21		77
22		75
23		76
24		74
25		73
26		72
27		70
28		156
29		69
30		155
31		68
32		65
33		66
34		64
35		63
36		62
37		61
38		60

5 - 7 Carlton Gardens Fan Coil Unit Address Schedule

11/2/00

3RD FLOOR EAST		
UNIT REF		SEACHANGE ADDRESS
20		103
21		102
22		130
23		104
24		100
25		99
26		98
27		97
28		96
29		95
30		93
31		94
32		90
33		86
34		92
35		91
36		89
37		88
38		87

3RD FLOOR WEST		
UNIT REF		SEACHANGE ADDRESS
1		89
2		88
3		90
4		106
5		92
6		93
7		94
8		91
9		154
10		95
11		96
12		103
13		97
14		105
15		100
16		102
17		101
18		98
19		99

4TH FLOOR EAST		
UNIT REF		SEACHANGE ADDRESS
20		65
21		84
22		75
23		85
24		76
25		105
26		106
27		107
28		108
29		110
30		109
31		136
32		112
33		113
34		114
35		115
36		117
37		116
38		118

4TH FLOOR WEST		
UNIT REF		SEACHANGE ADDRESS
1		108
2		107
3		109
4		110
5		112
6		133
7		113
8		114
9		135
10		115
11		136
12		137
13		119
14		120
15		121
16		122
17		123
18		125
19		124

5 - 7 Carlton Gardens Fan Coil Unit Address Schedule

11/2/00

5TH FLOOR EAST		
UNIT REF		SEACHANGE ADDRESS
12		119
13		120
14		121
15		126
16		122
17		127
18		123
19		124
20		125
21		128
22		129

5TH FLOOR WEST		
UNIT REF		SEACHANGE ADDRESS
1		142
2		143
3		144
4		145
5		146
6		148
7		147
8		149
9		150
10		151
11		152

C.1 BEMS Points Schedules

C.1.1 Control Panel MCCB/1

IQ251 ANALOGUE INPUT CONFIGURATION			LAN	O/S 15	LOCATION MCCB/1			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
A1	AN	BOILER 1 FLOW TEMP. SENSOR 100/TIX/001						
A2	AN	BOILER 2 FLOW TEMP. SENSOR 100/TIX/002						
A3	AN	COMMON PRIMARY FLOW TEMP.100/TIX/003						
A4	AN	COMMON PRIMARY RETURN TEMP. 100/TIX/ 004						
A5	AN	MIXED FLOW TEMP. SENSOR 101/TIX/001						
A6	AN	DHWS CALORIFIER 1 TEMP. SENSOR 103/TIX/001						
A7	AN	DHWS CALORIFIER 2 TEMP. SENSOR 103/TIX/002						
A8	AN	MIXED FLOW TEMP. SENSOR 104/TIX/001						
B9	AN	UNDER FLOOR HEATING PUMP No.1 105/SPC/001 STATUS						
B10	AN	UNDER FLOOR HEATING PUMP No.2 105/SPC/002 STATUS						
B11	AN	UNDER FLOOR HEATING TEMP. SENSOR 1105/TIX/001						
B12	AN							
B13	AN							
B14	AN	DHWS CALORIFIER PUMP1 103/SPC/001						
B15	AN	DHWS CALORIFIER PUMP2 103/SPC/002						
B16	AN	DHWS CALORIFIER 1 HIGH LIMIT THERMOSTAT 103/THL/001						
C17	AN	DHWS CALORIFIER 2 HIGH LIMIT THERMOSAT 103/THL/002						
C18	AN	RADIATOR & LANDLORDS HEATING PUMP1 104/SPC/001						
C19	AN	RADIATOR & LANDLORDS HEATING PUMP2 104/SPC/002						
C20	AN	ACB M2 OPEN / CLOSE 500/VFC/004						
C21	AN							
C22	AN	ACB M2 OUT SERVICE 500/VFC/006						
C23	AN							
C24	AN							
D25	AN							
D26	AN							
D27	AN							
D28	AN							
D29	AN							
D30	AN							
D31	AN							
D32	AN							

IQ251 DIGITAL INPUT CONFIGURATION			LAN	O/S 15	LOCATION MCCB/1			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
A1	DIG	BOILER 1 COMMON LOCK OUT						
A2	DIG	BOILER 1 COMMON HIGH LIMIT						
A3	DIG	BOILER 2 COMMON LOCK OUT						
A4	DIG	BOILER 2 COMMON HIGH LIMIT						
A5	DIG	AHU SECONDARY HEATING PUMP 102/SPC/001 FLOW						
A6	DIG	AHU SECONDARY HEATING PUMP 102/SPC/002 FLOW						
A7	DIG	FCU SECONDARY HEATING PUMP STATUS 101/SPC/001						
A8	DIG	FCU SECONDARY HEATING PUMP STATUS 101/SPC/002						
B9	DIG	PRIMARY PUMP 1 LOW SPEED STATUS						
B10	DIG	PRIMARY PUMP 1 HIGH SPEED STATUS						
B11	DIG	PRESSURISATION UNIT 100/PRU/001 COMMON FAULT						
B12	DIG	PRESSURISATION UNIT 100/PRU/001 RUN STATUS 1						
B13	DIG	PRESSURISATION UNIT 100/PRU/001 RUN STATUS 2						
B14	DIG	LTHW LOW PRESSURE SWITCH 100/LPS/001						
B15	DIG	LTHW HIGH PRESSURE SWITCH 100/HPS/001						
B16	DIG	HIGH LIMIT 100/TIS/001						
C17	DIG	EMERGENCY STOP BUTTON 100/ESB/001 & 2						
C18	DIG	GAS DETECTED SENSOR 100/GCS/001						
C19	DIG	GAS DETECTED SENSOR 100/GCS/002						
C20	DIG	GAS DETECTED SENSOR 100/GCS/003						
C21	DIG							
C22	DIG	GAS DETECTED SENSOR 100/GCS/005						
C23	DIG	GAS DETECTION SYSTEM FAULT 100/FLT/001						
C24	DIG	BOILER ROOM SAFETY CIRCUIT OPERATED 100/VFC/003						
D25	DIG	GAS SOLENOID VALVE OPEN ENDSWITCH 100/VES/001						
D26	DIG	GAS SOLENOID VALVE CLOSED ENDSWITCH 100/VES/002						
D27	DIG	COMBUSTION FANS RUNNING 100/VFC/005						
D28	DIG	PRIMARY PUMP 2 LOW SPEED STATUS						
D29	DIG	PRIMARY PUMP 2 HIGH SPEED STATUS						
D30	DIG	BOILER BANK ISOLATION VALVE 100/CVO/001						
D31	DIG	BOILER BANK ISOLATION VALVE 100/CVO/002						
D32	DIG							

IQ251 OUTPUT CONFIGURATION			#REF!	#REF!	LOCATION			
Location	O/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
E1	DO	FRESH AIR FANS REQUIRED						
E2	DO	PRIMARY HEATING PUMP 1 LOW SPEED						
E3	DO	PRIMARY HEATING PUMP 1 HIGH SPEED						
E4	DO	PRIMARY HEATING PUMP 2 LOW SPEED						
E5	DO	PRIMARY HEATING PUMP 2 HIGH SPEED						
E6	DO	BOILER 1 ENABLE						
E7	DO	BOILER 2 ENABLE						
E8	DO							
F9	DO							
F10	DO	BOILER BANK 1 ISOLATION VALVE 100/CVO/001						
F11	DO	BOILER BANK 2 ISOLATION VALVE 100/CVO/002						
F12	DO							
F13	DO							
F14	DO	FCU SECONDARY HEATING PUMP ENABLE 101/SPC/001						
F15	DO	FCU SECONDARY HEATING PUMP ENABLE 101/SPC/002						
F16	DO	RADIATOR AND LANDLORDS HEATING PUMP 1						
G17	DO	RADIATOR AND LANDLORDS HEATING PUMP 2						
G18	DO	DHWS PUMP 1 ENABLE						
G19	DO	AHU SECONDARY HEATING PUMP ENABLE 102/SPC/001						
G20	DO	AHU SECONDARY HEATING PUMP ENABLE 102/SPC/002						
G21	DO	UNDER FLOOR HEATING PUMP No.1 105/SPC/001 ENABLE						
G22	DO	UNDER FLOOR HEATING PUMP No.2 105/SPC/002 ENABLE						
G23	DO	UNDER FLOOR HEATING MIXING VALVE 105/CVM/001						
G24	DO							
H25	AO	MIXING VALVE 101/CVM/001						
H26	AO	CALORIFIER 1 CONTROL VALVE						
H27	AO	CALORIFIER 2 CONTROL VALVE						
H28	AO	MIXING VALVE 104/CVM/001						
H29	AO							
H30	AO							
H31	AO							
H32	AO							

IQ251 ANALOGUE INPUT CONFIGURATION			LAN	O/S 11	LOCATION MCCB/1			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
A1	AN	CHILLER 1 FLOW TEMP. SENSOR 200/TIX/001						
A2	AN	CHILLER 2 FLOW TEMP. SENSOR 200/TIX/002						
A3	AN	COMMON CHILLED WATER PRIMARY FLOW TEMP. 200/TIX/003						
A4	AN	COMMON CHILLED WATER PRIMARY RETURN TEMP.200/TIX/004						
A5	AN	WT1 HIGH LEVEL 400/HLS/001						
A6	AN	WT1 LOW LEVEL 400/LLS/001						
A7	AN	WT2 HIGH LEVEL 400/HLS/002						
A8	AN	WT2 LOW LEVEL 400/LLS/002						
B9	AN	WT3 HIGH LEVEL 400/HLS/003						
B10	AN	WT3 LOW LEVEL 400/LLS/003						
B11	AN	SP1 COMMON FAULT 400/FLT/001						
B12	AN	FP1 COMMON FAULT 400/FLT/002						
B13	AN	DWP1 COMMON FAULT 400/FLT/003						
B14	AN	DWP2 COMMON FAULT 400/FLT/004						
B15	AN	SWMH1 COMMON FAULT 400/FLT/005						
B16	AN	SWMH2 COMMON FAULT 400/FLT/006						
C17	AN	SWMH3 COMMON FAULT 400/FLT/007						
C18	AN	FWMH3 FAULT 400/FLT/008						
C19	AN	FWMH4 FAULT 400/FLT/009						
C20	AN	CPMH4 FAULT 400/FLT/010						
C21	AN							
C22	AN	ACB M1 OPEN / CLOSE 500/VFC/001						
C23	AN	ACB M1 FAULT TRIP 500/VFC/002						
C24	AN	ACB M1 OUT SERVICE 500/VFC/003						
D25	AN	COND WTR PRESSURISATION UNIT PU02 COMMON FAULT 200/PRU/001						
D26	AN	COND WTR PRESSURISATION UNIT PU02 PUMP 1 RUN 200/PRU/001						
D27	AN	COND WTR PRESSURISATION UNIT PU02 PUMP 2 RUN 200/PRU/001						
D28	AN	COND WTR SYSTEM LOW PRESSURE SWITCH 200/LPS/003						
D29	AN	COND WTR SYSTEM HIGH PRESSURE SWITCH 200/LPS/004						
D30	AN	CHILLER SEQUENCER COMMON FAULT						
D31	AN	REFRIGERANT GAS DETECTOR UNIT FAULT						
D32	AN							

IQ251 DIGITAL INPUT CONFIGURATION			LAN	O/S 11	LOCATION MCCB/1			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
A1	DIG	MAIN ISOLATOR STATUS						
A2	DIG	CHILLER No. 1 COMMON FAULT 200/VFC/001						
A3	DIG	CHILLER No. 2 COMMON FAULT 200/VFC/002						
A4	DIG							
A5	DIG							
A6	DIG							
A7	DIG	FCU1 SECONDARY CHILLED WATER PUMPS STATUS 201/SPC/001						
A8	DIG	FCU2 SECONDARY CHILLED WATER PUMPS STATUS 201/SPC/002						
B9	DIG	AHU1 SECONDARY CHILLED WATER PUMPS STATUS 202/SPC/001						
B10	DIG	AHU2 SECONDARY CHILLED WATER PUMPS STATUS 202/SPC/002						
B11	DIG	CHILLED WATER PRIMARY PUMP 1 STATUS 200/PPC/001						
B12	DIG	CHILLED WATER PRIMARY PUMP 2 STATUS 200/PPC/002						
B13	DIG							
B14	DIG	PRIMARY CONDENSED WATER PUMP 1 STATUS 200/PPC/003						
B15	DIG	PRIMARY CONDENSED WATER PUMP 2 STATUS 200/PPC/004						
B16	DIG	EMERGENCY STOP BUTTON 200/ESB/002						
C17	DIG	CHILLER 1 LOW LEVEL ALARM 200/GSC/001						
C18	DIG	CHILLER 2 LOW LEVEL ALARM 200/GSC//002						
C19	DIG	CHILLER 1 HIGH LEVEL ALARM 200/GSC/003						
C20	DIG	CHILLER 2 HIGH LEVEL ALARM 200/GSC/004						
C21	DIG							
C22	DIG	CHW PRESSURISATION UNIT PU01 PUMP 1 RUN 200/PRU/001						
C23	DIG	CHW PRESSURISATION UNIT PU01 PUMP 2 RUN 200/PRU/001						
C24	DIG	CHILLED WATER SYSTEM LOW PRESSURE SWITCH 200/LPS/001						
D25	DIG	CHILLED WATER SYSTEM HIGH PRESSURE SWITCH 200/HPS/001						
D26	DIG	FIRE SHUTDOWN						
D27	DIG	GENERAL INCOMER ELECTRICITY METER 500/VFC/017						
D28	DIG	MAINS INCOMER ELECTRICITY METER 500/VFC/018						
D29	DIG	RES. GRD FLR DIS BOARD ELECTRICITY METER 500/VFC/019						
D30	DIG	RES. 6TH FLR DIS BOARD ELECTRICITY METER 500/VFC/020						
D31	DIG	RES. 7TH FLR DIS BOARD ELECTRICITY METER 500/VFC/021						
D32	DIG	RES. LIFT ELECTRICITY METER 500/VFC/022						

IQ251 OUTPUT CONFIGURATION			#REF!	O/S 11	LOCATION			
Location	O/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
E1	DO	FCU1 SECONDARY CHW PUMPS ENABLE 201/SPC/001						
E2	DO	FCU2 SECONDARY CHW PUMPS ENABLE 201/SPC/002						
E3	DO	AHU1 SECONDARY CHW PUMPS ENABLE 202/SPC/001						
E4	DO	AHU2 SECONDARY CHW PUMPS ENABLE 202/SPC/002						
E5	DO	CHILLER SEQUENCER ENABLE						
E6	DO	PRIMARY CONDENSER WATER PUMP 1 ENABLE 200/PPC/003						
E7	DO	PRIMARY CONDENSER WATER PUMP 2 ENABLE 200/PPC/004						
E8	DO	PRIMARY CHW PUMP 1 ENABLE 200/PPC/001						
F9	DO	PRIMARY CHW PUMP 2 ENABLE 200/PPC/002						
F10	DO							
F11	DO							
F12	DO							
F13	DO							
F14	DO							
F15	DO							
F16	DO							
G17	DO							
G18	DO							
G19	DO							
G20	DO							
G21	DO							
G22	DO							
G23	DO							
G24	DO							
H25	AO							
H26	AO							
H27	AO							
H28	AO							
H29	AO							
H30	AO							
H31	AO							
H32	AO							

IQ241 INPUT/OUTPUT CONFIGURATION			LAN	O/S 12	LOCATION MCCB/1			
Location	I/P-0/P	Function	Comments	S Card Type	Commissioned	Date	Witnessed	Date
1	DIG I/P	WATER METER 400/VFC/001		N/A				
2	DIG I/P	WATER METER 400/VFC/002		N/A				
3	DIG I/P	WATER METER 400/VFC/003		N/A				
4	DIG I/P	WATER METER 400/VFC/004		N/A				
5	DIG I/P	WATER METER 400/VFC/005		N/A				
6	DIG I/P	WATER METER 400/VFC/006		N/A				
7	DIG I/P	ACB G1 OPEN / CLOSE 500/VFC/007		N/A				
8	DIG I/P	ACB G1 FAULT 500/VFC/008		N/A				
9	DIG I/P	ACB G1 OUT OF SERVICE 500/VFC/009		N/A				
10	DIG I/P	ACB G2 OPEN / CLOSE 500/VFC/010		N/A				
11	DIG I/P	ACB G2 FAULT 500/VFC/011		N/A				
12	DIG I/P	ACB G2 OUT OF SERVICE 500/VFC/012		N/A				
13	UNIV I/P	MAINS FAIL / MAINS AVAILABLE 500/VFC/013		SCDI				
14	UNIV I/P	GEN. AVAILABLE / NOT AVAILABLE 500/VFC/014						
15	UNIV I/P	SYSTEM NORMAL 500/VFC/015		SCDI				
16	UNIV I/P	GEN. COMMON FAULT 500/VFC/016						
17	UNIV I/P							
18	UNIV I/P							
19	UNIV I/P							
20	UNIV I/P							
21	UNIV							
22	UNIV							
23	UNIV							
24	UNIV							
25	UNIV							
26	UNIV							
27	UNIV							
28	UNIV							
29	UNIV							
30	UNIV							
31	UNIV							
32	UNIV							
33	AN O/P			N/A				
34	AN O/P			N/A				
35	AN O/P			N/A				
36	AN O/P			N/A				
37	AN O/P			N/A				
38	AN O/P			N/A				
39	AN O/P			N/A				
40	AN O/P			N/A				

C.1.2 Control Panel MCCB/2

IQ251 ANALOGUE INPUT CONFIGURATION | LAN | O/S 13 | LOCATION MCCB/2

Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
A1	AN	SYSTEM 1 SUPPLY AIRFLOW MEASURING STATION						
A2	AN	SYSTEM 1 EXTRACT AIRFLOW MEASURING STATION						
A3	AN	SYSTEM 2 SUPPLY AIRFLOW MEASURING STATION						
A4	AN	SYSTEM 2 EXTRACT AIRFLOW MEASURING STATION						
A5	AN							
A6	AN							
A7	AN	AHU01 SUPPLY FAN DIFFERENTIAL PRESSURE SENSOR						
A8	AN	AHU01 EXTRACT FAN DIFFERENTIAL PRESSURE SENSOR						
B9	AN	AHU01 FROST BATTERY TEMPERATURE SENSOR						
B10	AN	AHU01 SUPPLY AIR TEMPERATURE SENSOR						
B11	AN							
B12	AN	AHU01 EXHAUST RELATIVE HUMIDITY SENSOR (FURURE HUMIDIFIER)						
B13	AN	AHU02 SUPPLY FAN SPEED CONTROL FEEDBACK						
B14	AN	AHU02 EXTRACT FAN SPEED CONTROL FEEDBACK						
B15	AN							
B16	AN							
C17	AN	AHU02 SUPPLY FAN DIFFERENTIAL PRESSURE SENSOR						
C18	AN	AHU02 EXTRACT FAN DIFFERENTIAL PRESSURE SENSOR						
C19	AN	AHU02 FROST BATTERY TEMPERATURE SENSOR						
C20	AN	AHU02 SUPPLY AIR TEMPERATURE SENSOR						
C21	AN	BOILER ROOM ELECTRIC HEATER BATTERY CUTOUT						
C22	AN	AHU02 EXHAUST RELATIVE HUMIDITY SENSOR (FUTURE HUMIDIFIER)						
C23	AN	BMS/SECURITY ROOM SUPPLY AIR TEMPERATURE SENSOR						
C24	AN	BOILER ROOM SUPPLY AIR TEMPERATURE SENSOR						
D25	AN	AHU01 SUPPLY FAN SPEED CONTROL FEEDBACK						
D26	AN	AHU01 EXTRACT FAN SPEED CONTROL FEEDBACK						
D27	AN	BOILER ROOM PANEL FILTER DIRTY						
D28	AN	AHU01 RETURN AIR TEMPERATURE						
D29	AN	AHU02 RETURN AIR TEMPERATURE						
D30	AN	BOILER ROOM FROST SHUTDOWN						
D31	AN							
D32	AN							

IQ251 DIGITAL INPUT CONFIGURATION			#REF!	O/S 13	LOCATION MCCB/2			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
A1	DIG	SMOKE DAMPER INPUT						
A2	DIG	WORKSHOP VENTILATION SUPPLY FAN AIR FLOW						
A3	DIG	FIRE SHUTDOWN						
A4	DIG	AHU01 SUPPLY FAN FAULT						
A5	DIG	AHU01 SUPPLY FAN RUNNING						
A6	DIG	AHU01 SUPPLY FAN IN MANUAL CONTROL						
A7	DIG	AHU01 EXTRACT FAN FAULT						
A8	DIG	AHU01 EXTRACT FAN RUNNING						
B9	DIG	AHU01 EXTRACT FAN IN MANUAL CONTROL						
B10	DIG	AHU01 FRESH AIR ISOLATION DAMPER OPEN						
B11	DIG	AHU01 EXHAUST AIR ISOLATION DAMPER OPEN						
B12	DIG	AHU01 FROST SHUTDOWN						
B13	DIG	AHU02 SUPPLY FAN FAULT						
B14	DIG	AHU02 SUPPLY FAN RUNNING						
B15	DIG	AHU02 SUPPLY FAN IN MANUAL CONTROL						
B16	DIG	AHU02 EXTRACT FAN FAULT						
C17	DIG	AHU02 EXTRACT FAN RUNNING						
C18	DIG	AHU02 EXTRACT FAN IN MANUAL CONTROL						
C19	DIG	AHU02 FRESH AIR ISOLATION DAMPER OPEN						
C20	DIG	AHU02 EXHAUST AIR ISOLATION DAMPER OPEN						
C21	DIG	AHU02 FROST SHUTDOWN						
C22	DIG	BMS/SECURITY ROOM SUPPLY FAN AIR FLOW						
C23	DIG	BMS/SECURITY ROOM SUPPLY FAN PANEL FILTER DIRTY						
C24	DIG	BMS/SECURITY ROOM ELECTRIC HEATER BATTERY HIGH TEMP C'OUT						
D25	DIG	BMS/SECURITY ROOM VENTILATION FROST SHUTDOWN						
D26	DIG	SPLIT A/C UNIT COMMON FAULT (V.F.C)						
D27	DIG	W/SHOP VENT SUPPLY FAN CURRENT SENSING RELAY ACTIVETED						
D28	DIG	BOILER ROOM SUPPLY FAN 1 CURRENT SENSING RELAY ACTIVATED						
D29	DIG	BOILER ROOM SUPPLY FAN 1 FAN AVAILABLE						
D30	DIG	BOILER ROOM SUPPLY FAN 2 CURRENT SENSING RELAY ACTIVATED						
D31	DIG	BOILER ROOM SUPPLY FAN 2 FAN AVAILABLE						
D32	DIG	BOILER ROOM COMBUSTION FANS REQUIRED						

IQ251 OUTPUT CONFIGURATION			#REF!	O/S 13	LOCATION MCCB/2			
Location	O/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
E1	DO	AHU01 SUPPLY FAN ENABLE						
E2	DO	AHU01 EXTRACT FAN ENABLE						
E3	DO	AHU02 SUPPLY FAN ENABLE						
E4	DO	AHU02 EXTRACT FAN ENABLE						
E5	DO	BMS/SECURITY ROOM SUPPLY FAN ENABLE						
E6	DO	BMS/SECURITY ROOM ELECTRIC HEATER BATTERY ENABLE						
E7	DO	WORKSHOP VENTILATION SUPPLY FAN ENABLE						
E8	DO	BOILER ROOM SUPPLY FAN No.1 ENABLE						
F9	DO	BOILER ROOM SUPPLY FAN No.2 ENABLE						
F10	DO	BOILER ROOM SUPPLY FAN DUTY SELECT						
F11	DO	BOILER ROOM ELECTRIC HEATER BATTERY ENABLE						
F12	DO	FRESH AIR DAMPER OPEN COMMAND 2/CDO/001						
F13	DO	EXHAUST AIR DAMPER OPEN COMMAND 2/CDO/002						
F14	DO	FRESH AIR DAMPER OPEN COMMAND 1/CDO/001						
F15	DO	EXHAUST AIR DAMPER OPEN COMMAND 1/CDO/002						
F16	DO							
G17	AO	AHU01 SUPPLY FAN SPEED CONTROL						
G18	AO	AHU01 EXTRACT FAN SPEED CONTROL						
G19	AO	AHU01 RECUPERATOR FACE/BYPASS DAMPERS						
G20	AO	AHU01 FROST BATTERY CONTROL VALVE						
G21	AO	AHU01 COOLER BATTERY CONTROL VALVE						
G22	AO	AHU01 HEATER BATTERY CONTROL VALVE						
G23	AO	AHU02 SUPPLY FAN SPEED CONTROL						
G24	AO	AHU02 EXTRACT FAN SPEED CONTROL						
H25	AO	AHU02 RECUPERATOR FACE/BYPASS DAMPERS						
H26	AO	AHU02 FROST BATTERY CONTROL VALVE						
H27	AO	AHU02 COOLER BATTERY CONTROL VALVE						
H28	AO	AHU02 HEATER BATTERY CONTROL VALVE						
H29	AO	BMS/SECURITY ROOM ELECTRIC HEATER BATTERY CONTROL						
H30	AO	BOILER ROOM ELECTRIC HEATER BATTERY CONTROL						
H31	AO	BOILER ROOM ELECTRIC HEATER BATTERY CONTROL VALVE						
H32	AO							

IQ221 INPUT/OUTPUT CONFIGURATION			LAN	O/S 14	LOCATION MCCB/2			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	AHU01 STEAM HUMIDIFIER FAULT (FUTURE)						
IN2	UNIV	AHU02 STEAM HUMIDIFIER FAULT (FUTURE)						
IN3	UNIV	AHU01 SUPPLY HUMIDITY						
IN4	UNIV	AHU02 SUPPLY HUMIDITY						
IN5	UNIV	MAIN ISOLATOR STATUS						
IN6	UNIV	SPARE						
IN7	N/A							
IN8	N/A							
OP9	AO	AHU01 STEAM HUMIDIFIER CONTROL (FUTURE)						
OP10	AO	AHU02 STEAM HUMIDIFIER CONTROL (FUTURE)						
OP11	N/A							
OP12	N/A							
OP13	N/A							
OP14	N/A							
OP15	N/A							
OP16	DO	AHU01 STEAM HUMIDIFIER ENABLE (FUTURE)						
OP17	DO	AHU02 STEAM HUMIDIFIER ENABLE (FUTURE)						
OP18	DO							
OP19	DO							
OP20	DO							

IQ221 INPUT/OUTPUT CONFIGURATION			LAN	O/S 38	LOCATION MCCB/2			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	AHU01 PANEL FILTER DIFFERENTIAL PRESSURE SENSOR						
IN2	UNIV	AHU01 BAG FILTER DIFFERENTIAL PRESSURE SENSOR						
IN3	UNIV	AHU02 PANEL FILTER DIFFERENTIAL PRESSURE SENSOR						
IN4	UNIV	AHU02 BAG FILTER DIFFERENTIAL PRESSURE SENSOR						
IN5	UNIV							
IN6	UNIV							
IN7	N/A							
IN8	N/A							
OP9	AO							
OP10	AO							
OP11	N/A							
OP12	N/A							
OP13	N/A							
OP14	N/A							
OP15	N/A							
OP16	DO							
OP17	DO							
OP18	DO							
OP19	DO							
OP20	DO							

C.1.3 Control Panel MCC7/1

IQ241 INPUT/OUTPUT CONFIGURATION			LAN	O/S 34	LOCATION MCC7/1			
Location	I/P-O/P	Function	Comments	S Card Type	Commissioned	Date	Witnessed	Date
1	DIG I/P	MCC Main Supply Incoming Switch Disconector Status						
2	DIG I/P	Flat No. 1 Water Meter	Pulse					
3	DIG I/P	Fire Signal Plant Shutdown						
4	DIG I/P	AHU03 Supply Fan 3/SFC/001 Fan Running Status						
5	DIG I/P	Fresh Air Isolation Damper 'OPEN' Status						
6	DIG I/P	Panel Filter Differential Pressure Switch Status						
7	DIG I/P	Bag Filter Differrential Pressure Switch Status						
8	DIG I/P	Frost Thermostat						
9	DIG I/P	AHU03 Extract Fan No.1 3/EFC/001 Fan Running Status						
10	DIG I/P	AHU03 Extract Fan No.2 3/EFC/002 Fan Running Status						
11	DIG I/P	Exhaust Air Isolation Damper 'OPEN' Status						
12	DIG I/P	Steam Humidifier Common Fault						
13	UNIV I/P	Frost Battery Temperature Sensor		SCTI				
14	UNIV I/P	Supply Air Temperature Sensor						
15	UNIV I/P	Supply Relative Humidity Sensor		SCTI				
16	UNIV I/P	Exhaust Relative Humidity Sensor						
17	UNIV I/P	Outside Air Temperature Sensor		SCTI				
18	UNIV I/P	Outside Air Humidity Sensor						
19	UNIV I/P	Common Condenser Water Flow Temperature Sensor		SCTI				
20	UNIV I/P	Common Condenser Water Return Temperature Sensor						
21	UNIV			SCDI				
22	UNIV	Dry Air Cooler 2 Common Fault						
23	UNIV	Dry Air Cooler 3 Common Fault		SCDI				
24	UNIV	Flat No. 2 Water Meter	Pulse					
25	UNIV	Flat No. 3 Water Meter	Pulse					
26	UNIV	Flat No. 4 Water Meter	Pulse					
27	UNIV	Flat No. 5 Water Meter	Pulse					
28	UNIV	Flat No. 6 Water Meter	Pulse					
29	UNIV	AHU03 Extract Fan No.1 3/EFC/001 Enable		SCVO				
30	UNIV	Exhaust Air Isolation Command						
31	UNIV	AHU03 Extract Fan No.2 3/EFC/002 Enable		SCVO				
32	UNIV	Steam Humidifier Command						
33	AN O/P	AHU03 Supply Fan 3/SFC/001 Enable						
34	AN O/P	Fresh Air Isolation Damper Command						
35	AN O/P	Frost Battery Three-Port Control Valve						
36	AN O/P	Heater Battery Three-Port Control Valve						
37	AN O/P	Recuperator Face / Bypass Damper Command						
38	AN O/P	Steam Humidifier Control						
39	AN O/P	Condenser Water Three -Port Mixing Valve 200/CVM/001						
40	AN O/P	Condenser Water Three -Port Mixing Valve 200/CVM/002						

C.1.4 Control Panel MCP/1

IQ241 INPUT/OUTPUT CONFIGURATION			LAN	O/S 18	LOCATION MCP1			
Location	I/P-O/P	Function	Comments	S Card Type	Commissioned	Date	Witnessed	Date
1	DIG I/P	MCC Main Supply Incoming Switch Disconector Status						
2	DIG I/P	999/FIR/004 SP01 FIRE SIGNAL						
3	DIG I/P	999/FIR/005 SP02 FIRE SIGNAL						
4	DIG I/P	999/FIR/006 SP03 FIRE SIGNAL						
5	DIG I/P	999/FIR/007 SP01 FIREMAN'S OFF						
6	DIG I/P	999/FIR/008 SP02 FIREMAN'S OFF						
7	DIG I/P	999/FIR/009 SP03 FIREMAN'S OFF						
8	DIG I/P	999/FIR/010 SP01 FIREMAN'S RUN						
9	DIG I/P	999/FIR/011 SP02 FIREMAN'S RUN						
10	DIG I/P	999/FIR/012 SP03 FIREMAN'S RUN						
11	DIG I/P	SP01 COMMON FAN FAILED						
12	DIG I/P	SP02 COMMON FAN FAILED						
13	UNIV I/P	SP03 COMMON FAN FAILED		SCDI				
14	UNIV I/P	PRESSURISATION FAN SP01/01 AVAILABLE						
15	UNIV I/P	PRESSURISATION FAN SP01/02 AVAILABLE		SCDI				
16	UNIV I/P	PRESSURISATION FAN SP03/01 RUNNING (CURRENT SENSING RELAY)						
17	UNIV I/P	PRESSURISATION FAN SP03/01 AVAILABLE		SCDI				
18	UNIV I/P	PRESSURISATION FAN SP03/02 RUNNING (CURRENT SENSING RELAY)						
19	UNIV I/P	PRESSURISATION FAN SP03/02 AVAILABLE		SCDI				
20	UNIV I/P	PRESSURISATION FAN SP02/01 RUNNING (CURRENT SENSING RELAY)						
21	UNIV			SCDI				
22	UNIV	PRESSURISATION FAN SP02/02 RUNNING (CURRENT SENSING RELAY)						
23	UNIV	PRESSURISATION FAN SP02/02 AVAILABLE		SCDI				
24	UNIV							
25	UNIV	PRESSURISATION FAN SP01/01 RUNNING (CURRENT SENSING RELAY)		SCDI				
26	UNIV	PRESSURISATION FAN SP01/02 RUNNING (CURRENT SENSING RELAY)						
27	UNIV							
28	UNIV							
29	UNIV							
30	UNIV							
31	UNIV							
32	UNIV							
33	AN O/P							
34	AN O/P							
35	AN O/P							
36	AN O/P							
37	AN O/P							
38	AN O/P							
39	AN O/P							
40	AN O/P							

C.1.5 Control Panel MCP/2

IQ251 ANALOGUE INPUT CONFIGURATION			LAN	O/S 16	LOCATION MCP2			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
A1	AN	SF02 SUPPLY AIR TEMPERATURE SENSOR						
A2	AN	EXH01 EXTRACT FANS CARBON MONOXIDE SENSOR						
A3	AN	EXH01 EXTRACT FANS CARBON MONOXIDE SENSOR						
A4	AN							
A5	AN							
A6	AN							
A7	AN							
A8	AN							
B9	AN							
B10	AN							
B11	AN							
B12	AN							
B13	AN							
B14	AN							
B15	AN							
B16	AN							
C17	AN							
C18	AN							
C19	AN							
C20	AN							
C21	AN							
C22	AN							
C23	AN							
C24	AN							
D25	AN							
D26	AN							
D27	AN							
D28	AN							
D29	AN							
D30	AN							
D31	AN							
D32	AN							

IQ251 DIGITAL INPUT CONFIGURATION			#REF!	O/S 16	LOCATION MCP2			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
A1	DIG	999/FIR/013 FIRE SIGNAL						
A2	DIG	999/FIR/014 EXH01 FIREMAN'S OFF						
A3	DIG	999/FIR/015 SF02 FIREMAN'S OFF						
A4	DIG	999/FIR/016 EXH06 FIREMAN'S OFF						
A5	DIG	MAIN SUPPLY ISOLATOR STATUS						
A6	DIG	999/FIR/017 EXH07 FIREMAN'S OFF						
A7	DIG	SF02 SUPPLY FAN No.1 RUNNING (CURRENT SENSING RELAY)						
A8	DIG	SF02 SUPPLY FAN No.1 AVAILABLE						
B9	DIG	SF02 SUPPLY FAN No.2 RUNNING (CURRENT SENSING RELAY)						
B10	DIG	SF02 SUPPLY FAN No.2 AVAILABLE						
B11	DIG	SF02 SUPPLY FANS No.1&2 FILTER DIRTY						
B12	DIG	SF02 FROST SHUTDOWN						
B13	DIG	EXH06 EXTRACT FAN No.1 RUNNING (CURRENT SENSING RELAY)						
B14	DIG	EXH06 EXTRACT FAN No.1 AVAILABLE						
B15	DIG	EXH06 EXTRACT FAN No.2 RUNNING (CURRENT SENSING RELAY)						
B16	DIG	EXH06 EXTRACT FAN No.2 AVAILABLE						
C17	DIG	EXH07 EXTRACT FAN No.1 RUNNING (CURRENT SENSING RELAY)						
C18	DIG	EXH07 EXTRACT FAN No.1 AVAILABLE						
C19	DIG	EXH07 EXTRACT FAN No.2 RUNNING (CURRENT SENSING RELAY)						
C20	DIG	EXH07 EXTRACT FAN No.2 AVAILABLE						
C21	DIG							
C22	DIG	EXH01 EXTRACT FAN No.1 L/S RUNNING (CURRENT SENSING RELAY)						
C23	DIG	EXH01 EXTRACT FAN No.1 H/S RUNNING (CURRENT SENSING RELAY)						
C24	DIG	EXH01 EXTRACT FAN No.2 AVAILABLE						
D25	DIG	EXH01 EXTRACT FAN No.2 L/S RUNNING (CURRENT SENSING RELAY)						
D26	DIG	EXH01 EXTRACT FAN No.2 H/S RUNNING (CURRENT SENSING RELAY)						
D27	DIG	999/FIR/018 EXH01 DUTY FAN RUN						
D28	DIG	999/FIR/019 SF02 DUTY FAN RUN						
D29	DIG	999/FIR/020 EXH06 DUTY FAN RUN						
D30	DIG	999/FIR/021 EXH07 DUTY FAN RUN						
D31	DIG	SD18 DAMPER END SWITCH STATUS						
D32	DIG	SD19 DAMPER END SWITCH STATUS						

IQ251 OUTPUT CONFIGURATION			#REF!	O/S 16	LOCATION MCP2			
Location	O/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
E1	DO	SF02 SUPPLY FANS ENABLE						
E2	DO							
E3	DO	SF02 SUPPLY FANS DUTY SELECT						
E4	DO	EXH06 EXTRACT FANS ENABLE						
E5	DO							
E6	DO	EXH06 EXTRACT FANS DUTY SELECT						
E7	DO							
E8	DO							
F9	DO							
F10	DO							
F11	DO	EXH07 EXTRACT FANS ENABLE						
F12	DO							
F13	DO	EXH07 EXTRACT FANS DUTY SELECT						
F14	DO							
F15	DO							
F16	DO	EXH01 EXTRACT FANS L/S ENABLE						
G17	DO	EXH01 EXTRACT FANS H/S ENABLE						
G18	DO	EXH02 EXTRACT FANS DUTY SELECT						
G19	DO							
G20	DO							
G21	DO							
G22	DO							
G23	DO							
G24	DO							
H25	AO	SF02 SUPPLY FANS HEATER BATTERY CONTROL VALVE						
H26	AO							
H27	AO							
H28	AO							
H29	AO							
H30	AO							
H31	AO							
H32	AO							

C.1.6 Control Panel MCP/3

IQ241 INPUT/OUTPUT CONFIGURATION			LAN	O/S 19	LOCATION MCP3			
Location	I/P-O/P	Function	Comments	S Card Type	Commissioned	Date	Witnessed	Date
1	DIG I/P	MAIN SUPPLY ISOLATOR STATUS						
2	DIG I/P	EXTRACT FAN EXH02/01 FAN AVAILABLE						
3	DIG I/P	EXTRACT FAN EXH02/01 FAN RUNNING L/S						
4	DIG I/P	EXTRACT FAN EXH02/01 FAN RUNNING H/S						
5	DIG I/P	EXTRACT FAN EXH02/02 FAN AVAILABLE						
6	DIG I/P	EXTRACT FAN EXH02/02 FAN RUNNING L/S						
7	DIG I/P	EXTRACT FAN EXH02/02 FAN RUNNING H/S						
8	DIG I/P	PRESSURE RELIEF FAN ISOLATION DAMPER 20/CDO/001 STATUS						
9	DIG I/P	AHU SMOKE ISOLATION DAMPER 20/CDO/002 STATUS						
10	DIG I/P	EXTRACT FANS EXH04/01 & 02 COMMON FAN FAIL						
11	DIG I/P	PRESSURE RELIEF FAN EXH04/01 FAN AVAILABLE						
12	DIG I/P	PRESSURE RELIEF FAN EXH04/01 FAN RUNNING						
13	UNIV I/P	PRESSURE RELIEF FAN EXH04/02 FAN AVAILABLE		SCDI				
14	UNIV I/P	PRESSURE RELIEF FAN EXH04/02 FAN RUNNING						
15	UNIV I/P	999/FIR/022 EXH02 + EXH04 FIRE SIGNAL		SCDI				
16	UNIV I/P	999/FIR/023 EXH02 FIREMAN'S OFF						
17	UNIV I/P	999/FIR/024 EXH04 FIREMAN'S OFF		SCDI				
18	UNIV I/P	999/FIR/025 EXH02 FIREMAN'S RUN						
19	UNIV I/P	999/FIR/026 EXH04 FIREMAN'S RUN		SCDI				
20	UNIV I/P	14/SFC/001 SUPPLY FAN STATUS						
21	UNIV	14/SFC/001 SUPPLY FAN AVAILABLE		SCDI				
22	UNIV	14/SFC/002 SUPPLY FAN STATUS						
23	UNIV	14/SFC/002 SUPPLY FAN AVAILABLE		SCDI				
24	UNIV	FRESH AIR FANS REQUIRED						
25	UNIV	14/SFC/001 & 14/SFC/002 SUPPLY FANS ELECTRIC HEATER BATTERY HIGH LIMIT		SCDI				
26	UNIV	14/SFC/001 & 14/SFC/002 SUPPLY FANS PANEL FILTER DIRTY						
27	UNIV	14/SFC/001 & 14/SFC/002 SUPPLY FANS FROST SHUTDOWN		SCDI				
28	UNIV							
29	UNIV			SCDI				
30	UNIV							
31	UNIV	14/SFC/001 & 14/SFC/002 SUPPLY FANSSUPPLY AIR SENSOR		SCCI				
32	UNIV							
33	AN O/P							
34	AN O/P	14/SFC/001 & 14/SFC/002 HEATER BATTERY CONTROL VALVE						
35	AN O/P	14/SFC/001 & 14/SFC/002 ELECTRIC HEATER BATTERY ENABLE						
36	AN O/P	14/SFC/001 & 14/SFC/002 DUTY SELECT						
37	AN O/P	14/SFC/001 & 14/SFC/002 COMMON ENABLE						
38	AN O/P	EXH02/01 + EXH02/02 COMMON H/S ENABLE						
39	AN O/P	EXH02/01 + EXH02/02 COMMON L/S ENABLE						
40	AN O/P	EXTRACT FANS EXH02 DUTY SELECTOR						

IQ221 INPUT/OUTPUT CONFIGURATION			LAN	O/S 40	LOCATION MCP3			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	EXH09 FAN No.1 RUNNING						
IN2	UNIV	EXH09 FAN No.1 AVAILABLE						
IN3	UNIV	COMMON FAULT						
IN4	UNIV	EXH09 FAN No.2 RUNNING						
IN5	UNIV	EXH09 FAN No.2 AVAILABLE						
IN6	UNIV	SPARE						
IN7	N/A							
IN8	N/A							
OP9	AO	SPARE						
OP10	AO	SPARE						
OP11	N/A							
OP12	N/A							
OP13	N/A							
OP14	N/A							
OP15	N/A							
OP16	DO	SPARE						
OP17	DO	SPARE						
OP18	DO	SPARE						
OP19	DO	SPARE						
OP20	DO	SPARE						

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S **	LOCATION MCP 3			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	SD27 DAMPER END SWITCH STATUS						
IN2	UNIV	SD28 DAMPER END SWITCH STATUS						
IN3	UNIV	SD37 DAMPER END SWITCH STATUS						
IN4	UNIV	SD27, 28, 37 FIRE SHUT SIGNAL						
IN5	UNIV	SD28, EXH09 & SF01 FIREMANS RUN SIGNAL						
IN6	UNIV	SD27, EXH09 FIREMANS RUN SIGNAL						
IN7	UNIV	SD37, EXH09 FIREMANS RUN SIGNAL						
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO							
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.7 Control Panel MCP/4

IQ241 INPUT/OUTPUT CONFIGURATION			LAN	O/S 35	LOCATION MCP4			
Location	I/P-O/P	Function	Comments	S Card Type	Commissioned	Date	Witnessed	Date
1	DIG I/P	MAIN SUPPLY ISOLATOR STATUS						
2	DIG I/P	EXTRACT FAN EXH03/01 FAN AVAILABLE						
3	DIG I/P	EXTRACT FAN EXH03/01 FAN RUNNING L/S						
4	DIG I/P	EXTRACT FAN EXH03/01 FAN RUNNING H/S						
5	DIG I/P	EXTRACT FAN EXH03/02 FAN AVAILABLE						
6	DIG I/P	EXTRACT FAN EXH03/02 FAN RUNNING L/S						
7	DIG I/P	EXTRACT FAN EXH03/02 FAN RUNNING H/S						
8	DIG I/P	PRESSURE RELIEF FAN ISOLATION DAMPER 21/CDO/001 STATUS						
9	DIG I/P	AHU SMOKE ISOLATION DAMPER 21/CDO/002 STATUS						
10	DIG I/P	EXTRACT FANS EXH05/01 & 02 COMMON FAN FAIL						
11	DIG I/P	PRESSURE RELIEF FAN EXH05/01 FAN AVAILABLE						
12	DIG I/P	PRESSURE RELIEF FAN EXH05/01 FAN RUNNING						
13	UNIV I/P	PRESSURE RELIEF FAN EXH05/02 FAN AVAILABLE		SCDI				
14	UNIV I/P	PRESSURE RELIEF FAN EXH05/02 FAN RUNNING						
15	UNIV I/P	BMS / SECURITY ROOM FLOW STATUS		SCDI				
16	UNIV I/P	999/FIR/027 EXH03 + EXH05 + EXH08 FIRE SIGNAL						
17	UNIV I/P	999/FIR/028 EXH03 FIREMAN'S OFF		SCDI				
18	UNIV I/P	999/FIR/029 EXH05 FIREMAN'S OFF						
19	UNIV I/P	999/FIR/030 EXH08 FIREMAN'S OFF		SCDI				
20	UNIV I/P	999/FIR/031 EXH03 FIREMAN'S RUN						
21	UNIV	SD36 DAMPER END SWITCH STATUS		SCDI				
22	UNIV	999/FIR/033 EXH08 FIREMAN'S RUN						
23	UNIV	SD36 FIRE SIGNAL						
24	UNIV	BMS / SECURITY ROOM TOILET EXTRACT FAN EXH08 COMMON FAULT INDICATION		SCDI				
25	UNIV							
26	UNIV							
27	UNIV							
28	UNIV							
29	UNIV							
30	UNIV							
31	UNIV							
32	UNIV							
33	AN O/P							
34	AN O/P							
35	AN O/P							
36	AN O/P							
37	AN O/P	BMS / SECURITY ROOM ENABLE						
38	AN O/P	SPARE						
39	AN O/P	EXH03/01 + EXH03/02 COMMON L/S ENABLE						
40	AN O/P	EXTRACT FANS EXH03 DUTY SELECTOR						

C.1.8 Smoke Control Panel SCP/LG/E

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 20	LOCATION SCP/LG/E			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.9 Smoke Control Panel SCP/LG/W

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 21	LOCATION SCP/LG/W			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.10 Smoke Control Panel SCP/G/N

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 22	LOCATION SCP/G/N			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.11 Smoke Control Panel SCP/G/S

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 23	LOCATION SCP/G/S			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.12 Smoke Control Panel SCP/1/E

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 24	LOCATION SCP/1/E			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.13 Smoke Control Panel SCP/1/W

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 25	LOCATION SCP/1/W			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.14 Smoke Control Panel SCP/2/E

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 26	LOCATION SCP/2/E			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.15 Smoke Control Panel SCP/2/W

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 27	LOCATION SCP/2/W			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.16 Smoke Control Panel SCP/3/E

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 28	LOCATION SCP/3/E			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.17 Smoke Control Panel SCP/3/W

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 29	LOCATION SCP/3/W			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.18 Smoke Control Panel SCP/4/E

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 30	LOCATION SCP/4/E			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.19 Smoke Control Panel SCP/4/W

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 31	LOCATION SCP/4/W			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.20 Smoke Control Panel SCP/5/E

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 32	LOCATION SCP/5/E			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

C.1.21 Smoke Control Panel SCP/5/W

IQ223 INPUT/OUTPUT CONFIGURATION			LAN	O/S 33	LOCATION SCP/5/W			
Location	I/P	Function	Comments	Field Device	Commissioned	Date	Witnessed	Date
IN1	UNIV	CLOSE SMOKE DAMPERS 'FIRE SIGNAL'						
IN2	UNIV	OPEN EXTRACT SMOKE DAMPER 'FIRE SIGNAL'						
IN3	UNIV	COMMON SMOKE DAMPERS 'OPEN SIGNAL'						
IN4	UNIV	CHILLED WATER Kwh METER	PULSED INPUT					
IN5	UNIV	LTHW Kwh METER	PULSED INPUT					
IN6	UNIV	VENTILATION REQUIRED SIGNAL FROM FCU's						
IN7	UNIV							
IN8	DI							
OP9	AO							
OP10	AO							
OP11	AO							
OP12	AO							
OP13	AO							
OP14	AO							
OP15	AO							
OP16	DO	SUPPLY & EXTRACT DAMPERS OPEN/CLOSE SIGNAL						
OP17	N/A							
OP18	N/A							
OP19	N/A							
OP20	N/A							

D

5-7 CARLTON GARDENS
LONDON SW1

OPERATING & MAINTENANCE INSTRUCTIONS
for the
BUILDING SERVICES

VOLUME 2
BUILDING MANAGEMENT SYSTEM

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VOLUME 2 – Building Management System

INDEX

VOLUME 2.1

SECTION D OPERATION OF THE INSTALLATION

D.1.0 GENERAL OPERATING INSTRUCTIONS

Total distrubuted control of the building is achieved by integrating two building management systems. Trend IQ controllers control the main plant and Seachange controls the floor environmental controls and all fan coil units. Both systems are supervised from a graphical user interface package called Doorway.

The basement houses the entire main plant, eg boilers, chillers, calorifiers, east and west air handling units, primary and secondary pumps, east and west smoke extraction fans etc. All office floors have been segregated into two imaginary half's, for both control and mechanical installation. The lower ground floor plus floors one to five have been segregated east and west in accordance with compass bearings. There are two entrances to the building on the ground floor, facing east and west respectively. So this floor is segretaged north and south in accordnace with compass bearings. Each half of the floor has a Seachange master controller that dictates what the office temperature should be, when the fan coil units and air handling units are enabled, returning heating and cooling demands and the opening and closing of the respective floor supply and extract isolation dampers. These conditions will be over-ridden by hardwire interface cabling so that in a fire condition the respective supply isolation dampers close and the extract isolation dampers go to their command position as by the fire alarm IAT system. Tempered fresh air for each floor is supplied by two air-handling units, one for the east side of the building and another for the west side of the building. The amount of fresh air into the floors is determined by how many floors are in occupancy, as each floor has an allocated amount. This is the same for the extract system. Extract ducting is also used for smoke clearance in a fire condition. In this condition the relevant air-handling unit is isolated and high velocity extract fans are started. A firemans over-ride switch located in the IAT control room provides some extract fans with ultimate control.

D.1.1 Weather Station - System 0

GENERAL

The weather station consists of an outside air temperature sensor

and an outside air humidity sensor.

1. Sensing equipment associated with system 0 is connected to control panel MCC7/1.
2. The outside air temperature and relative humidity sensors are located on a north facing wall. The sensors are shielded from direct sunlight, located away from any exhaust louvres or other sources of heat, and a separate cover shield the senors from contact with snow and rain.
3. The temperature and humidity valves are transmitted globally to all systems requiring the valves via the BMS communications network.

D.1.2 AHU01 (East Office Ventilation) - System 1

GENERAL

1 The air handling unit supplies air to, and extracts air from, the east side of the office areas from the lower ground to the fifth floor. Air is supplied to the offices via the backs of the fan coil units on each floor.

2 The supply side of the AHU consists of a variable speed supply fan, an inlet air damper, a frost coil, a panel filter, a bag filter, an air-to-air recuperator with face and bypass dampers, a cooler battery and a heater battery. There is space in the AHU for the future addition of a steam humidifier.

3 The extract side of the AHU consists of a variable speed extract fan, the exhaust part of the air-to-air recuperator, and an exhaust isolation damper.

4 There are motorised smoke dampers on both the supply and extract branches to the office floors from the main supply and extract risers. These are controlled both by the BMS for floor isolation purposes, and also by the fire detection system. (Refer to systems 30 to 36 for more details).

5 In a fire condition, the extract section of the AHU is isolated via a smoke damper; and by opening up another smoke damper, the east staircase pressurisation relief fans (system 20) are connected to the east office extract riser.

6 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Motor Control Centre Details

7 Control equipment and switchgear associated with this plant is housed in Control Panel MCC B/2.

8 Inverter drives are mounted outside of the Control Panel, local to their associated fan motor drives, within their own IP54 enclosures.

9 Selector switches and indicator lamps are incorporated on the facia of Control Panel MCC B/2 as follows.

MOTOR CONTROL CENTRE MCC B/2		
TITLE	SWITCH POSITION	INDICATION
EAST OFFICE AHU SUPPLY FAN 1/SFV/001	TEST/OFF/AUTO FROST RESET (PUSH-BUTTON)	RUNNING/FAULT/SPEED (RPM METER) FROST SHUTDOWN
EAST OFFICE AHU SUPPLY FAN 1/SFV/001 SPEED CONTROL	0-100% POTENTIOMETER	UNDER MANUAL CONTROL
EAST OFFICE AHU EXTRACT FAN 1/EFV/001	TEST/OFF/AUTO	RUNNING/FAULT
EAST OFFICE AHU EXTRACT FAN 1/EFV/001 SPEED CONTROL	0-100% POTENTIOMETER	SPEED (RPM METER) UNDER MANUAL CONTROL

TEST

10 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied. The speed of the fan is controlled by the manual potentiometer on the panel facia, which is operational only in the test position.

OFF

11 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

12 When all of the switches are in there 'auto' positions the BMS controls strategy applies as described below:-

System Start

13 The system is started and stopped under the dictates of the requirements of the seven AHU RUN signals from the Office Floor (East) fan coil unit systems (systems 30 to 36). With one or more AHU RUN signals present, the AHU will start. Upon loss of all seven signals, the AHU will stop.

14 On plant start up, the following start up sequence applies.

(i) When the outside air temperature is below the supply air setpoint, then a HEATING DEMAND signal is sent to system 102. The plant waits for an AHU HEAT AVAILABLE signal from system 102 before proceeding with the rest of the start-up sequence. If the outside air temperature is at or above the supply air setpoint, the start-up sequence will proceed immediately.

(ii) When the outside air temperature is below 8°c, the frost battery and the heater battery three-port control valves opens fully to pre-heat the coils. After a time delay of [1] minutes, or immediately if no pre-heat is needed, the intake and exhaust isolation dampers will drive open.

(iii) Upon receipt of open status' from both damper's endswitches, first the supply fan, and [10] seconds later the extract fan will be enabled to run, the fan speed control loops enabled, and the temperature control loops enabled.

Fan Speed Control

15 Whenever the supply or extract fans are enabled to run the speed control output to the inverter drives will not fall below a 20Hz value. This is to make sure that a healthy status received from the D.P sensors across the fans.

16 The supply fan speed is modulated via a proportional plus integral plus differential control loop, in order to maintain the supply air volume, as sensed by the supply airflow measuring station, at its setpoint.

17 The supply air volume setpoint is derived from the number of office floors in an occupied mode. Each office floor has an assigned supply air volume setpoint. The office floors running in an occupied mode have their associated supply air volume setpoints summated within the software strategy to give the required supply air volume setpoint.

18 The extract fan speed is modulated via a proportional plus integral plus differential control loop, in order to maintain the extract air volume, as sensed by the extract airflow measuring station, at its setpoint.

19 The extract air volume setpoint is derived from the number of office floors in an occupied mode. Each office floor has an assigned extract air volume setpoint. The office floors running in an occupied mode have their associated extract air volume setpoints summated to give the required extract air volume setpoint within the software strategy.

Recuperator Operation

20 The recuperator and its associated face and bypass dampers operate in either a heating or cooling mode.

21 When the off frost-coil temperature is equal to or less than the return air temperature, the recuperator face and bypass dampers operate in a heating mode, such that the full bypass position equates to 0% heating and the full flow through the recuperator position equates to 100% heating.

22 When the off frost-coil temperature is greater than the return air temperature, the recuperator operates in a cooling mode such that the full bypass position equates to 0% cooling and the full flow through the recuperator position equates to 100% cooling.

23 Once a mode of operation has been selected, the recuperator operates in that mode for a minimum period of 10 minutes. The mode of operation is displayed on the BMS operator's station graphics.

Supply Air Temperature Control

24 The supply air temperature sensor modulates, in sequence, the heater battery control valve, the recuperator face and bypass dampers, and the cooler battery control valve, via a proportional plus integral action control loop, in order to maintain the supply air temperature at its setpoint ±0.1K.

25 The supply air setpoint is scheduled against outside air temperature in a proportional manner such that at 4°c outside, the supply air setpoint will be 20°c, rising to 22°c at 23°c outside. The supply air setpoint does not exceed these limits.

Temperature Control Alarm Limits

26 The supply air temperature sensor provides out of limits alarms on the BMS when the sensed temperature exceeds 2°c or more above or below the setpoint. The alarms are inhibited whenever the AHU is shut down and for 10 minutes after plant startup or a change in the supply air volume setpoint.

Frost Coil Control

27 The frost coil three-port control valve is modulated via a proportional plus integral action control loop to maintain an off-coil setpoint of 8°c as sensed by an averaging element sensor located downstream of the coil.

Frost Shutdown

28 An averaging element auto-reset frost thermostat is serpentined across the downstream face of the frost coil. The thermostat is set to trip below 4°c. In the event of the frost thermostat tripping a critical alarm is raised on the BMS operator's station and the supply and extract fans are hardwired to stop. The frost coil valve and heater battery valves are driven to their full flow to coil positions. The cooler battery valve is driven to the full flow to bypass position and the intake and exhaust isolation dampers will be driven closed. After 11 minutes, the frost coil and heater battery three-port control valves drive to the full bypass position.

29 The frost thermostat is hardwired into a latching circuit within the Control Panel, such that to restart the AHU, an operator has to push the frost reset button on the panel fascia, and, provided that the sensed frost condition has cleared, the circuit resets.

30 Resetting of the frost circuit allows the AHU to restart in its normal startup manner, providing at least one of its associated office floors is in an occupied mode. Otherwise, the AHU remains in a shutdown state until next required to run.

Heating and Cooling Demand Signals

31 The AHU secondary CHW circuit (system 202) is sent a COOLING DEMAND signal when the AHU is running provided there is a cooling requirement. The cooling demand signal is derived from the output signal to the cooler battery control valve. When the valve reaches the 10% open position and remains at or above10% for a period of

10 minutes, the refrigeration plant is sent a COOLING DEMAND signal.

32 When the valve closes and remains closed for a period of 10 minutes, the COOLING DEMAND signal is removed. When the valve reaches the 10% open position again, the cycle repeats.

33 The heater battery and frost coil control valves send to the AHU secondary LPHW circuit (system 102) a HEATING DEMAND signal in a similar manner as the cooling valve, except that the HEATING DEMAND signal is sent the moment any valve moves from the full bypass position, without any time delay. The HEATING DEMAND is removed when both valves have closed and remain closed for a period of 10 minutes.

34 The valve positions and delay times are individually adjustable for each of the two demands.

Plant Shutdown

35 When the plant is required to shut down by the loss of all seven AHU RUN signals from the office FCU systems, the supply and extract fans will stop, the frost, heater and cooler battery valves drive closed to their coils and the intake and exhaust isolating dampers close.

36 If during the shutdown period the outside air temperature falls to 1°c or below then the frost and heater battery valves are driven to the full flow to coil position. When the outside air temperature rises above 2°c the valves drive closed to their coils.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Supply Fan

37 The supply fan is monitored for its running status by its associated inverter's running status and differential pressure sensor.

Extract Fan

38 The extract fan is monitored for its running status by its associated inverter's running status and differential pressure sensor.

Fan Failure

39 In the event of a supply or extract fan failure, detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station and the failed fan commanded off. A software flag for the failed flag is set. The remaining air handling unit equipment are configured as described under PLANT SHUTDOWN.

40 With either the supply or extract fan failed, the air handling unit will not re-enter the normal automatic control sequence until the BMS operator acknowledges that the fault on the fan has been cleared, at the BMS operator's station by resetting the associated fan failed flag.

Inverter / Fan Requirements

41 Each inverter accepts a control input signal voltage of 0-10V DC for inverter speed output and a volt free contact input for start/enable. The inverter will not increase the fan speed output until the start/enable input is energised.

42 Each inverter provides volt free contacts for running and fault monitoring on the BMS.

43 Power supplied to an inverter is disconnected via a contactor when;

(i) Its associated control panel switch is selected to the off position,
(ii) The inverter has been isolated,
(iii) The fan is locally isolated.

44 The fans are provided with a means of manual speed control. Should a problem arise with the BMS.

45 To achieve manual control, each fan is provided with an auxiliary pole on the test/off/auto switch and a calibrated potentiometer located on the facia of the motor control centre MCC B/2. Manual speed control is achieved by placing the selector switch to the test position and then adjusting the Potentiometer knob to the desired setting.

46 When auto is selected, the associated variable speed fan is controlled as required by the BMS, as detailed under Plant Startup and Volume Permoor Pressure Control. When a fan is required to run the BMS start/enable signal is energised and the required fan speed is selected by the 0-10V-speed output signal.

47 When manual is selected the associated fan speed is controlled by the calibrated potentiometer.

48 Indication of fan under manual speed control is provided on the BMS. The signal to the BMS is provided via an auxiliary pole of the two-position switch.

49 A 4 to 20mA signal representing output frequency is provided from each fan inverter drive for monitoring fan speed on the BMS.

Isolation Damper Monitoring

50. The intake and exhaust isolation dampers are monitored individually for an open status via open position endswitches on their associated damper actuators.

51 Should a damper be commanded open, and the associated open status is not received within 120 seconds, or the damper is being commanded open, an open status is subsequently lost, an alarm is be raised for that damper at the BMS operator's station, a failure flag for that damper set, and the AHU will be put in the shutdown state. This is done to prevent the fan operating against a closed damper.

52 The AHU will not restart until an operator from the BMS operator's station has reset the failure flag.

Panel Filter

53 The panel filter is monitored by a differential pressure sensor. In the event that the differential pressure across the filter is indicative of a dirty filter an alarm is raised on the BMS operator's terminal.

Bag Filter

54 The bag filter is monitored by a differential pressure sensor. In the event that the differential pressure across the filter is indicative of a dirty filter an alarm is raised on the BMS operator's terminal.

Smoke Damper Monitoring

55 The BMS monitors for a closed endswitch status from the AHU extract duct smoke damper.

56 Should a closed status be received whilst no fire signal is present for the AHU, the AHU is hardwired to shutdown as in a fire condition, and an 'extract smoke damper failure' alarm raised at the BMS operator's station.

Future Humidification Allowances

57 Space has been allowed in the AHU for the addition of a future humidifier. If fitted, the humidifier will be powered from a dedicated electrical supply.

58 To ensure that the BMS system has the capacity to control the future humidifier, all necessary outstation points, wiring, terminals, hardwire interlocks and all necessary software (disabled from operating) is provided under this contract. No field equipment or field wiring is provided. The graphics are not include for the humidifier points and associated software.

59 The necessary outstation points will be as described in the BMS point schedule.

60 The controls strategy if enabled will be as follows:

61 The supply duct humidity sensor will modulate the control output to the humidifier via a proportional plus integral control loop to maintain a minimum supply humidity of 41% rh.

62 Provided that the supply fan status is present, whenever the control output to the humidifier exceeds 10% for longer than 2 minutes, the enable output to the humidifier will be energised. This output will also be hardwired through the supply fan inverter's 'run' signal, to allow the interlock to work with the AHU running in the 'test' position.

63 The BMS will monitor the common extract relative humidity sensor.

64 The BMS will monitor the humidifier for a common fault condition and upon its occurrence, will disable the humidifier, set a failure flag in software, and will raise an alarm at the BMS operator's station.

65 The humidifier will remain off under automatic control until the failure flag has been reset via the BMS operator's station.

Fire Control

66 The plant is hardwire interlocked with the fire detection system as described under **FIRE CONTROL** (System 999).

Plant Restart Sequence

67 The plant is interlocked, through software, to sequentially re-start following:

1. Fire alarm shutdown.
2. Power failure.

D.1.3 AHU02 (West Office Ventilation) - System 2

GENERAL

1 The air handling unit supplies air to, and extracts air from, the west side of the office areas from the lower ground to the fifth floor. Air is supplied to the offices via the backs of the fan coil units on each floor.

2 The supply side of the AHU consists of a variable speed supply fan, an inlet air damper, a frost coil, a panel filter, a bag filter, an air-to-air recuperator with face and bypass dampers, a cooler battery and a heater battery. There is space in the AHU for the future addition of a steam humidifier.

3 The extract side of the AHU consists of a variable speed extract fan, the exhaust part of the air-to-air recuperator, and an exhaust isolation damper.

4 There are motorised smoke dampers on both the supply and extract branches to the office floors from the main supply and extract risers. These are controlled both by the BMS for floor isolation purposes, and also by the fire detection system. (Refer to systems 37 to 43 for more details).

5 In a fire condition, the extract section of the AHU is isolated via a smoke damper; and by opening up another smoke damper, the west staircase pressurisation relief fans (system 21) are connected to the west office extract riser.

6 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Motor Control Centre Details

7 Control equipment and switchgear associated with this plant is housed in Motor Control Centre MCC B/2.

8 Inverter drives are mounted outside of the MCC, local to their associated fan motor drives, within their own IP54 enclosures.

9 Selector switches and indicator lamps are incorporated on the facia of Motor Control Centre MCC B/2 as follows.

MOTOR CONTROL CENTRE MCC B/2		
TITLE	SWITCH POSITIONS	INDICATION
WEST OFFICE AHU SUPPLY FAN 2/SFV/001	TEST/OFF/AUTO FROST RESET (PUSH-BUTTON)	RUNNING/FAULT/SPEED (RPM METER)/FROST SHUTDOWN
WEST OFFICE AHU SUPPLY FAN 2/SFV/001 SPEED CONTROL	0-100% POTENTIOMETER	UNDER MANUAL CONTROL
WEST OFFICE AHU EXTRACT FAN 2/EFV/001	TEST/OFF/AUTO	RUNNING/FAULT/SPEED (RPM METER)
WEST OFFICE AHU EXTRACT FAN 2/EFV/001 SPEED CONTROL	0-100% POTENTIOMETER	UNDER MANUAL CONTROL

TEST

10 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied. The speed of the fan is controlled by the manual potentiometer on the panel facia only in the test position.

OFF

11 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant will configure itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

12 When all of the switches are in their 'auto' positions the following controls strategy will apply.

System Start

13 The system starts and stop under the dictates of the requirements of the seven AHU RUN signals from the Office Floor (West) fan coil unit systems (systems 37 to 43). With one or more AHU RUN signals present, the AHU will be started. Upon loss of all seven signals, the AHU will stop.

14 On plant start up, the following start up sequence applies.

(i) If the outside air temperature is below the supply air setpoint, then a HEATING DEMAND signal is sent to system 102. The plant then waits for an AHU HEAT AVAILABLE signal from system 102 before proceeding with the rest of the start-up sequence. If the outside air temperature is at or above the supply air setpoint, the start-up sequence will proceed immediately.

(ii) If the outside air temperature is below 8°C, the frost battery and the heater battery three-port control valves will open fully to pre-heat the coils. After a time delay of 1 minute, or immediately if no pre-heat was needed, the intake and exhaust isolation dampers will be driven open.

(iii) Upon receipt of open status' from both damper's endswitches, first the supply fan, and 10 seconds later the extract fan will be enabled to run, the fan speed control loops enabled, and the temperature control loops enabled.

Fan Speed Control

15 Whenever the supply or extract fans are enabled to run, the speed control output to the inverter drives will not fall below a 20Hz value. This is to make sure that a healthy status received from the DP sensors across the fans.

16 The supply fan speed is modulated via a proportional plus integral plus differential control loop, in order to maintain the supply air volume, as sensed by the supply airflow measuring station, at its setpoint.

17 The supply air volume setpoint is derived from the number of office floors in an occupied mode. Each office floor has an assigned supply air volume setpoint. The office floors running in an occupied mode have their associated supply air volume setpoints summated within the software stragety to give the required supply air volume setpoint.

18 The extract fan speed is modulated via a proportional plus integral plus differential control loop, in order to maintain the extract air volume, as sensed by the extract airflow measuring station, at its setpoint.

19 The extract air volume setpoint is derived from the number of office floors in an occupied mode. Each office floor has an assigned extract air volume setpoint. The office floors running in an occupied mode have their associated extract air volume setpoints summated to give the required extract air volume setpoint.

20 The individual floor supply and extract airflow setpoint values are accessible for adjustment via an engineering page associated with the main AHU graphic.

Recuperator Operation

21 The recuperator and its associated face and bypass dampers operate in either a heating or cooling mode.

22 When the off frost-coil temperature is equal to or less than the return air temperature, the recuperator face and bypass dampers operate in a heating mode, such that the full bypass position equates to 0% heating and the full flow through the recuperator position equates to 100% heating.

23 When the off frost-coil temperature is greater than the return air temperature, the recuperator will operate in a cooling mode such that the full bypass position equates to 0% cooling and the full flow through the recuperator position equates to 100% cooling.

24 Once a mode of operation has been selected, the recuperator operates in that mode for a minium period of [10] minutes. The mode of operation is displayed on the BMS operator's station graphics.

Supply Air Temperature Control

25 The supply air temperature sensor modulates, in sequence, the heater battery control valve, the recuperator face and bypass dampers, and the cooler battery control valve, via a proportional plus integral action control loop, in order to maintain the supply air temperature at its setpoint ±0.1K.

26 The supply air setpoint is scheduled against outside air temperature in a proportional manner such that at [4.0]°C outside, the supply air setpoint will be [20.0]°C, rising to [22.0]°C at [23]°C outside. The supply air setpoint will not exceed the given limits.

Temperature Control Alarm Limits

27 The supply air temperature sensor provides out of limits alarms on the BMS when the sensed temperature exceeds [2.0]K or more above or below the setpoint. The alarms are inhibited whenever the AHU is shut down, and for [10] minutes after plant startup or a change in the supply air volume setpoint.

Frost Coil Control

28 The frost coil three-port control valve is modulated via a proportional plus integral action control loop to maintain an off-coil setpoint of [8.0]°C, as sensed by an averaging element sensor located downstream of the coil.

Frost Shutdown

29 An averaging element auto-reset frost thermostat has been serpentined across the downstream face of the frost coil. The thermostat has been set to trip below 4°C. In the event of the frost thermostat tripping a critical alarm is raised on the BMS operator's station and the supply and extract fans hardwired to stop. The frost coil valve and heater battery valve are driven to their full flow to coil positions. The cooler battery valve is driven to the full flow to bypass position and the intake and exhaust isolation dampers driven closed. After 11 minutes, the frost coil and heater battery three-port control valves driven to the full bypass position.

30 The frost thermostat is hardwired into a latching circuit within the MCC, such that to restart the AHU, an operator has to push the frost reset button on the MCC fascia, and, provided that the sensed frost condition has cleared, the circuit resets.

31 Resetting of the frost circuit allows the AHU to restart in its normal startup manner, providing at least one of its associated office floors is in an occupied mode. Otherwise, the AHU remains in a shutdown state until next required to run.

Heating and Cooling Demand Signals

32 The AHU secondary CHW circuit (system 202) is sent a COOLING DEMAND signal when the AHU is running (via the supply fan `status') provided there is a cooling requirement. The cooling demand signal is derived from the output signal to the cooler battery control valve. When the valve reaches the [10]% open position and remains at or above [10]% for a period of [10] minutes, the refrigeration plant is sent a COOLING DEMAND signal.

33 When the valve closes and remains closed for a period of [10] minutes, the COOLING DEMAND signal is removed. When the valve reaches the [10]% open position again, the cycle will repeat.

34 The heater battery and frost coil control valves send to the AHU secondary LPHW circuit (system 102) a HEATING DEMAND signal in a similar manner as the cooling valve, except that the HEATING DEMAND signal is sent the moment any valve moves from the full bypass position, without any time delay. The HEATING DEMAND is removed when both valves have closed and remain closed for a period of 10 minutes.

35 The valve positions and delay times are individually adjustable for each of the two demands.

Plant Shutdown

36 When the plant is required to shut down by the loss of all seven AHU RUN signals from the office FCU systems, the supply and extract fans will stop, the frost, heater and cooler battery valves drive closed to their coils and the intake and exhaust isolating dampers will close.

37 If during the shutdown period the outside air temperature falls to 1°C or below then the frost and heater battery valves are driven to the full flow to coil position. When the outside air temperature rises above 2°C the valves are driven closed to their coils.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Supply Fan

38 The supply fan is monitored for its running status by its associated inverter's running status and differential pressure sensor.

Extract Fan

39 The extract fan is monitored for its running status by its associated inverter's running status and differential pressure sensor.

Fan Failure

40 In the event of a supply or extract fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an appropriate alarm is raised on the BMS operator's station and the failed fan commanded off. A software flag for the failed flag is set. The remaining air handling unit equipment will be configured as described under PLANT SHUTDOWN.

41 With either the supply or extract fan failed, the air handling unit will not re-enter the normal automatic control sequence until the BMS operator acknowledges that the fault on the fan has been cleared, at the BMS operator's station by resetting the associated fan failed flag.

Inverter / Fan Requirements

42 Each inverter accepts a control input signal voltage of 0-10V DC for inverter speed output and a volt free contact input for start/enable. The inverter will not increase the fan speed output until the start/enable input is energised.

43 Each inverter provides volt free contacts for running and fault monitoring on the BMS.

44 Power supplied to an inverter is disconnected via a contactor when;

(i) Its associated motor control centre switch is selected to the off position,

(ii) The inverter has been isolated,

(iii) The fan is locally isolated.

45 The fans are provided with a means of manual speed control.

46 To achieve manual control, each fan is provided with either an auxiliary pole on the test/off/auto switch and a calibrated potentiometer located on the facia of motor control centre MCC B/2 or, a manual/auto speed selection and speed adjustment facility incorporated on each frequency inverter.

47 When auto is selected, the associated variable speed fan is controlled as required by the BMS, as detailed under Plant Startup and Volume Permoor Pressure Control. When a fan is required to run the power supply to its associated inverter is energised, the BMS start/enable signal will be energised and the required fan speed selected by the 0-10V speed output signal.

48 When manual is selected the associated fan speed is controlled by the calibrated potentiometer or by the speed adjustment facility incorporated on the inverter.

49 Indication of fan under manual speed control is provided on the BMS. The signal to the BMS is provided via an auxiliary pole of the two-position switch or via a volt free contact within the frequency inverter dependent on the method of manual speed control adopted.

50 A 4 to 20mA or 0 to 10V DC signal representing output frequency is provided from each fan inverter drive for monitoring fan speed on the BMS.

51 The inverter manufacturer's recommended mechanical and electrical installation procedures will be fully adhered to. Particular care will be taken to observe the inverter manufacturer's recommendations with regard to disconnection of supplies on-load upstream and downstream of the inverter and take any precautions recommended in order to avoid damaging the inverter.

Isolation Damper Monitoring

52 The intake and exhaust isolation dampers are each monitored for an open status via open position endswitches on their associated damper actuators.

53 Should a damper be commanded open, and the associated open status is not received within [120] seconds, or the damper is being commanded open and open status is subsequently lost, an alarm is raised for that damper at the BMS operator's station, a failure flag for that damper set, and the AHU will be put in the shutdown state.

54 The AHU will not restart until the failure flag has been reset by an operator from the BMS operator's station.

Panel Filter

55 The panel filter is monitored by a differential pressure sensor. In the event that the differential pressure across the filter is indicative of a dirty filter an alarm is raised on the BMS operator's terminal.

Bag Filter

56 The bag filter is monitored by a differential pressure sensor. In the event that the differential pressure across the filter is indicative of a dirty filter an alarm is raised on the BMS operator's terminal.

Smoke Damper Monitoring

57 The BMS monitors for a closed endswitch status from the AHU extract duct smoke damper.

58 Should a closed status be received whilst no fire signal is present for the AHU, the AHU is hardwired to shutdown as in a fire condition, and an 'extract smoke damper failure' alarm raised at the BMS operator's station.

Future Humidification Allowances

59 Space has been allowed in the AHU for the addition of a future humidifier. If fitted, the humidifier will be powered from a dedicated electrical supply and therefore no allowance for power need be made within the MCC.

60 To ensure that the BMS system has the capacity to control the humidifier, all necessary outstation points, wiring, terminals, hardwire interlocks and all necessary software (disabled from operating) will be provided under this contract. No field equipment or field wiring will be provided. The graphics s2hall not include for the humidifier points and associated software.

61 The necessary outstation points will be as described in the BMS point schedule.

62 The controls strategy will be as follows:

63 The supply duct humidity sensor will modulate the control output to the humidifier via a proportional plus integral control loop to maintain a minimum supply humidity of [41]% rh.

64 Provided that the supply fan status is present, whenever the control output to the humidifier exceeds [10]% for longer than [2] minutes, the enable output to the humidifier will be energised. This output will also be hardwired through the supply fan inverter's 'run' signal, to allow the interlock to work with the AHU running in the 'test' position.

65 The BMS will monitor the common extract relative humidity sensor.

66 The BMS will monitor the humidifier for a common fault condition and upon its occurrence, will disable the humidifier, set a failure flag in software, and will raise an alarm at the BMS operator's station.

67 The humidifier will remain off under automatic control until the failure flag has been reset via the BMS operator's station.

Fire Control

68 The plant is hardwire interlocked with the fire detection system as described under **FIRE CONTROL** (System 999).

Plant Restart Sequence

69 The plant is interlocked, through software, to sequentially re-start following:

1. Fire alarm shutdown.
2. Power failure.

D.1.4 AHU03 (Office Core Lobby & Toilet Ventilation) - System 3

GENERAL

1 The air handling unit supplies air to the office toilets from the lower ground to the fifth floors, plantrooms and other miscellaneous areas. The AHU extracts air from the toilets only.

2 The supply side of the AHU consists of a constant speed supply fan, an inlet air damper, a frost coil, a panel filter, a bag filter, an air-to-air recuperator with face and bypass dampers and a heater battery. There is space in the AHU for the future addition of a steam humidifier.

3 The extract side of the AHU consists of duty/standby constant speed extract fans with associated backflap dampers, the exhaust part of the air-to-air recuperator, and an exhaust isolation damper.

4 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Motor Control Centre Details

5 Control equipment and switchgear associated with this plant are housed in Motor Control Centre MCC 7/1.

6 Selector switches and indicator lamps are incorporated on the facia of Motor Control Centre MCC 7/1 as follows.

MOTOR CONTROL CENTRE MCC 7/1		
TITLE	SWITCH POSITIONS	INDICATION
AHU03 SUPPLY FAN 3/SFC/001	TEST/OFF/AUTO FROST RESET (PUSH-BUTTON)	RUNNING/TRIPPED/ FROST SHUTDOWN
AHU03 EXTRACT FAN No.1 2/EFC/001	TEST/OFF/AUTO	RUNNING/TRIPPED
AHU03 EXTRACT FAN No.2 2/EFC/002	TEST/OFF/AUTO	RUNNING/TRIPPED

TEST

7 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

8 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

9 When all of the switches are in their 'auto' positions the following controls strategy will apply.

System Start

10 The system will start and stop under the dictates of its own time schedule. There will also be a software point to allow an operator to manually start and stop the plant via the BMS operator's station.

11 On plant start up, the following start up sequence will apply.

(i) If the outside air temperature is below the supply air setpoint, then a HEATING DEMAND signal is sent to systems 100 and 102. The plant then waits for an AHU HEAT AVAILABLE signal from system 102 before proceeding with the rest of the start-up sequence. If the outside air temperature is at or above the supply air setpoint, the start-up sequence will proceed immediately.

(ii) If the outside air temperature is below [8] C, the frost battery and the heater battery three-port control valves will open fully to pre-heat the coils. After a time delay of [1] minute, or immediately if no pre-heat was needed, the intake and exhaust isolation dampers will be driven open.

(iii) Upon receipt of open status' from both damper's endswitches, first the supply fan, and [10] seconds later the duty extract fan will be enabled to run and the temperature control loops enabled.

Recuperator Operation

12 The recuperator and its associated face and bypass dampers operate in either a heating or cooling mode.

13 When the off frost-coil temperature is equal to or less than the return air temperature, the recuperator face and bypass dampers operate in a heating mode, such that the full bypass position equates to 0% heating and the full flow through the recuperator position equates to 100% heating.

14 When the off frost-coil temperature is greater than the return air temperature, the recuperator operate in a cooling mode such that the full bypass position equates to 0% cooling and the full flow through the recuperator position equates to 100% cooling.

15 Once a mode of operation has been selected, the recuperator will operate in that mode for a minium period of 10 minutes. The mode of operation is displayed on the BMS operator's station graphics.

Supply Air Temperature Control

16 The supply air temperature sensor modulates, in sequence, the heater battery control valve and the recuperator face and bypass dampers, via a proportional plus integral action control loop, in order to maintain the supply air temperature at its setpoint. As there is no cooling available, the supply air temperature will rise above setpoint in warm ambient conditions.

17 A temperature sensor located in the female ground floor toilets resets the supply air temperature setpoint between the limits of 19°C and 23°C in order to maintain the space at its setpoint of 21°C.

Frost Coil Control

18 The frost coil three-port control valve is modulated via a proportional plus integral action control loop to maintain an off-coil setpoint of 8.0°C, as sensed by an averaging element sensor located downstream of the coil.

Frost Shutdown

19 An averaging element auto-reset frost thermostat is serpentined across the downstream face of the frost coil. The thermostat is set to trip below 4°C. In the event of the frost thermostat tripping a critical alarm is raised on the BMS operator's station and the supply and extract fans hardwired to stop. The frost coil valve and heater battery valve will be driven to their full flow to coil positions and the intake and exhaust isolation dampers be driven closed. After 11 minutes, the frost coil and heater battery three-port control valves will be driven to the full bypass position.

20 The frost thermostat is hardwired into a latching circuit within the MCC, such that to restart the AHU, an operator has to push the frost reset button on the MCC fascia, and, provided that the sensed frost condition has cleared, the circuit will reset.

21 Resetting of the frost circuit allows the AHU to restart in its normal startup manner, providing that the AHU is in a time schedule period, otherwise, the AHU remains in a shutdown state until next required to run.

Heating Demand Signal

22 The heater battery and frost coil control valves send a HEATING DEMAND signal to the AHU secondary LTHW circuit (system 102) when any valve moves from the full bypass position, without any time delay. The HEATING DEMAND is removed when both valves have closed and remain closed for a period of 10 minutes.

Plant Shutdown

23 When the plant is required to shut down by the time schedule or operator command, the supply and extract fans will stop, the frost and heater battery valves are driven closed to their coils and the intake and exhaust isolating dampers closed.

24 If during the shutdown period the outside air temperature falls to 1°C or below then the frost and heater battery valves will be driven to the full flow to coil position. When the outside air temperature rises above 2°C the valves will be driven closed to their coils.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Supply Fan

25 The supply fan is monitored for its running status by a differential pressure switch piped across the fan and wired in series with a normally open auxiliary contact on the motor's starter.

26 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, will be inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

27 In the event of a supply fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station and the fan commanded off. A software flag for the failed flag is set. The remaining air handling unit equipment has been configured as described under PLANT SHUTDOWN.

Extract Fans

28 The extract fans have been arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the fans are off.

29 The extract fans are monitored for individual running status', with a common differential pressure switch, piped across both fans, wired in series with an auxiliary contact on the respective fan's starter.

30 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, is inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

31 In the event of a supply fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station and the fan commanded off. A software flag for the failed flag will be set.

32 If the duty fan fails, the standby fan immediately start and the duty point changed to make that fan the duty fan. The automatic timed duty changeover will be inhibited until the failure flag for the failed fan has been reset by an operator.

33 If with one fan failed, the other fan of the pair fails, an additional alarm is raised, which will only clear when one or both fan failed flags for the pair have been reset. In addition, the remaining air handling unit equipment has been configured as described under PLANT SHUTDOWN.

Fan Failure

34 With either the supply or extract fan failed, the air handling unit will not re-enter the normal automatic control sequence until the BMS operator acknowledges that the fault on the fan has been cleared, at the BMS operator's station by resetting the associated fan failed flag.

Isolation Damper Monitoring

35 The intake and exhaust isolation dampers are monitored individually for an open status via open position endswitches on their associated damper actuators.

36 Should a damper be commanded open, and the associated open status is not received within 120 seconds, or the damper is being commanded open and open status is subsequently lost, an alarm is raised for that damper at the BMS operator's station, a failure flag for that damper set, and the AHU is put in the shutdown state.

37 The AHU will not restart until the failure flag has been reset by an operator from the BMS operator's station.

Panel Filter

38 The panel filter is monitored by a differential pressure switch. In the event that the differential pressure across the filter is indicative of a dirty filter an alarm is raised on the BMS operator's terminal.

Bag Filter

39 The bag filter is monitored by a differential pressure switch. In the event that the differential pressure across the filter is indicative of a dirty filter an alarm is raised on the BMS operator's terminal.

Future Humidification Allowances

40 Space has been allowed in the AHU for the addition of a future humidifier. If fitted, the humidifier will be powered from a dedicated electrical supply by others.

41 To ensure that the BMS system has the capacity to control the future humidifier, all necessary outstation points, wiring, terminals, hardwire interlocks and all necessary software (disabled from operating) is provided under this contract. No field equipment or field wiring is provided. The graphics are not include for the humidifier points and associated software.

42 The necessary outstation points will be as described in the BMS point schedule.

43 The controls strategy if enabled will be as follows:

44 The supply duct humidity sensor will modulate the control output to the humidifier via a proportional plus integral control loop to maintain a minimum supply humidity of 41% rh.

45 Provided that the supply fan status is present, whenever the control output to the humidifier exceeds 10% for longer than 2 minutes, the enable output to the humidifier will be energised. This output will also be hardwired through the supply fan inverter's 'run' signal, to allow the interlock to work with the AHU running in the 'test' position.

46 The BMS will monitor the common extract relative humidity sensor.

47 The BMS will monitor the humidifier for a common fault condition and upon its occurrence, will disable the humidifier, set a failure flag in

software, and will raise an alarm at the BMS operator's station.

48 The humidifier will remain off under automatic control until the failure flag has been reset via the BMS operator's station.

Fire Control

49 The plant has been hardwire interlocked with the fire detection system as described under **FIRE CONTROL** (System 999).

Plant Restart Sequence

50 The plant has been interlocked, through software, to sequentially re-start following:

1. Fire alarm shutdown.
2. Power failure.

D.1.5 Basement Staffroom, Mailroom & Lift Motor Room Ventilation - System 4

GENERAL

1 Air is supplied to the basement staffroom, mailroom and lift motor rooms by supply fan set SF02 consisting of a constant speed fan. The fan has an associated mechanical non-return damper. Associated with SF02 is a LTHW heater battery.

2 Air is extracted from the basement staffroom, mailroom and two lift motor rooms by extract fan set EXH06 consisting of twin 2-speed extract fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

3 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

4 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 2.

5 Selector switches and indicator lamps are incorporated on the fascia of Motor Control Panel MCP 2 as follows

MOTOR CONTROL PANEL MCP 2		
TITLE	SWITCH POSITIONS	INDICATION
BASEMENT STAFFROOM & MAILROOM SUPPLY FAN No.1 SF02/01	TEST/OFF/AUTO	RUNNING/TRIPPED
BASEMENT STAFFROOM & MAILROOM SUPPLY FANS DUTY SELECTION	FROST RESET (PUSH-BUTTON)	FAN 1 DUTY/FAN 2 DUTY FROST SHUTDOWN
BASEMENT STAFFROOM & MAILROOM EXTRACT FAN No.1 EXH06/01	TEST/OFF/AUTO	RUNNING/TRIPPED
BASEMENT STAFFROOM & MAILROOM EXTRACT FAN No.2 EXH06/02	TEST/OFF/AUTO	RUNNING/TRIPPED

TEST

6 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

7 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

8 When all of the switches are in there 'auto' positions the following controls strategy will apply.

Plant Start

9 The plant start and stop under the dictates of the general basement time schedule, initially set for 24-hour operation. The time schedule is the same as System 1.

10 At the beginning of a time schedule period, the following start-up procedure applies.

(i) If the outside air temperature is below the supply air setpoint, then a HEATING DEMAND signal is sent to system 104. The plant then waits for a HEAT AVAILABLE signal from system 104 before proceeding with the rest of the start-up sequence. If the outside air temperature is at or above the supply air setpoint, the start-up sequence will proceed immediately.

(ii) If the outside air temperature is below 8°C, the heater battery three-port control valve open fully to pre-heat the coil. After a time delay of 1 minute, or immediately if no pre-heat was needed, first the duty supply fan will start and the temperature control loops enabled. and 10 seconds later the duty extract fan will be started.

Temperature Control

11 The supply air temperature sensor modulates the heater battery control valve via a proportional plus integral control loop, in order to maintain the supply air temperature at its setpoint of 17°C. As there is no cooling available, the supply air temperature will rise above the setpoint in high ambient conditions.

Plant Shutdown

12 At the end of the time schedule period, the duty supply and extract fans will stop and the three-port heater battery valve driven to the full flow to bypass position.

Frost Shutdown

13 An averaging element auto-reset frost thermostat has been serpentined across the downstream face of the heater battery. The thermostat is set to trip below 4°C. In the event of the frost thermostat tripping a critical alarm is raised on the BMS operator's station and the duty supply fan hardwired to stop. The heater battery valve is driven to the full flow to coil position. After 11 minutes, the heater battery three-port control valve is driven to the full bypass position.

14 The duty extract fan continues to run if required.

15 The frost thermostat is hardwired into a latching circuit within the MCP, such that to restart the supply fan, an operator has to push the frost-reset button on the MCP fascia, and, provided that the sensed frost condition has cleared, the circuit resets.

16 Resetting of the frost circuit allows the duty supply fan to restart in its normal startup manner, providing it is in an occupied mode. Otherwise, the duty supply fan remains in a shutdown state until next required to run.

Heating Demand Signal

17 The heater battery valve sends a HEATING DEMAND signal to system 104 when the valve moves from the full bypass position, without any time delay. The HEATING DEMAND is removed when the valve has closed and remains closed for a period of 10 minutes.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Supply Fan Monitoring & Control

18 An output from the BMS determines which fan of the pair is the duty fan. Another BMS output commands the selected duty fan to run. Indicator lamps on the panel fascia shows which fan is selected as the duty fan.

19 The fan is monitored for a running status via current sensing relays on all three of its power supply phases.

20 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, is inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

21 If the fan is commanded to run by a fire signal, then the fire signal is taken as the fan start command.

22 In the event of a fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station. A software flag for the failed fan is set.

23 If the duty fan fails, the duty selection output is changed to make the standby fan the duty fan. The automatic timed duty changeover is inhibited until the failure flag for the failed fan has been reset by an operator.

24 If with one fan failed, the other fan of the pair fails, an additional alarm indicating both fans are failed is raised, which will only clear when one or both fan failed flags for the pair have been reset. The duty select output will not change after the failure of the second fan. The heater battery control loop will be disabled and the three-port control valve driven to the full flow to bypass position and any HEATING DEMAND signal removed.

Extract Fan Monitoring & Control

25 The extract fans are arranged for automatic duty/standby operation, with duty selection being changed on a weekly basis, or upon fan failure.

26 An output from the BMS determines which fan of the pair is the duty fan. Another BMS output commands the selected duty fan to run in low speed. Indicator lamps on the panel fascia shows which fan is selected as the duty fan.

27 Each fan is monitored for running status via a set of current sensing relays on all three of its power supply phases.

28 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, will be inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

29 In the event of a fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station. A software flag for the failed fan is set.

30 If the duty fan fails, the duty selection output will change to make the standby fan the duty fan. The automatic timed duty changeover is inhibited until the failure flag for the failed fan has been reset by an operator.

31 If with one fan failed, the other fan of the pair fails, an additional alarm indicating both fans are failed is raised, which will only clear when one or both fan failed flags for the pair have been reset. The duty select output will not change after the failure of the second fan.

32 The duty supply fan is then turned off and the plant put in its shutdown state.

Control Circuit Monitoring

33 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost eg. Through the local isolator being turned off and breaking the control circuit, then an appropriate alarm is be raised at the BMS operator's terminal.

Fire System Monitoring

Fire Control

34 The plant is hardwire interlocked with the fire detection system as described under **FIRE CONTROL** (System 999).

Plant Restart Sequence

35 The plant is interlocked, through software, to sequentially re-start following:

1. Fire alarm shutdown.
2. Power failure.

D.1.6 Basement WCs and Refuse Room Extract Fans - System 5

GENERAL

1 The Basement WCs and the refuse room are ventilated by extract fan set EXH07, consisting of two constant speed fans operating in a duty/standby manner. (Each fan has an associated mechanical non-return damper).

2 Refer to the mechanical service drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

3 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 2.

4 Selector switches and indicator lamps are incorporated on the facia of Motor Control Panel MCP 2 as follows.

MOTOR CONTROL PANEL MCP 2		
TITLE	SWITCH POSITIONS	INDICATION
BASEMENT WC AND REFUSE ROOM EXTRACT FAN NO.1 EXH07/01	TEST/OFF/AUTO	RUNNING/ TRIPPED
BASEMENT WC AND REFUSE ROOM EXTRACT FAN NO.2 EXH07/02	TEST/OFF/AUTO	RUNNING/ TRIPPED
BASEMENT WC AND REFUSE ROOM EXTRACT FANS DUTY SELECTION	-	FAN 1 DUTY/FAN 2 DUTY

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in there 'auto' positions the following controls strategy apply.

Plant Start

8 The plant starts and stops under the dictates of the general basement time schedule, initially set for 24-hour operation. The time schedule is the same as System 4.

9 At the beginning of the time schedule period, the duty extract fan will start.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Extract Fan Monitoring & Control

10 The extract fans are arranged for automatic duty/standby operation, with duty selection being changed on a weekly basis, or upon fan failure.

11 An output from the BMS determines which fan of the pair is the duty fan. Another BMS output commands the selected duty fan to run. Indicator lamps on the panel fascia shows which fan is selected as the duty fan.

12 Each fan is monitored for a running status via current sensing relays on all three of its power supply phases.

13 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, is inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

14 If the fan is commanded to run by a fire signal, then the fire signal is taken as the fan start command.

15 In the event of a fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station. A software flag for the failed fan is set.

16 If the duty fan fails, the duty selection output is changed to make the standby fan the duty fan. The automatic timed duty changeover is inhibited until the failure flag for the failed fan has been reset by an operator.

If with one fan failed, the other fan of the pair fails, an additional alarm indicating both fans are failed is raised, which will only clear when one or both fan failed flags for the pair have been reset. The duty select output will not change after the failure of the second fan.

Control Circuit Monitoring

17 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost eg. Through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator's terminal.

D.1.7 Car Park Ventilation & Smoke Fans - System 6

GENERAL

1 The Car Park is ventilated by extract fan set EXH01, consisting of two 2-speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

2 Refer to the mechanical service drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

3 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 2.

4 Selector switches and indicator lamps are incorporated on the facia of Motor Control Panel MCP 2 as follows.

MOTOR CONTROL PANEL MCP 2		
TITLE	SWITCH POSITIONS	INDICATION
CAR PARK EXTRACT FAN NO.1 EXH01/01	HIGH SPEED TEST/LOW SPEED TEST/OFF/AUTO	HIGH SPEED RUNNING/LOW SPEED RUNNING/HIGH SPEED TRIPPED/LOW SPEED TRIPPED
CAR PARK EXTRACT FAN NO.2 EXH01/02	HIGH SPEED TEST/LOW SPEED TEST/OFF/AUTO	HIGH SPEED RUNNING/LOW SPEED RUNNING/HIGH SPEED TRIPPED/LOW SPEED TRIPPED
CAR PARK EXTRACT FANS DUTY SELECTION	-	FAN 1 DUTY/FAN 2 DUTY

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in there 'auto' positions the following controls strategy applies.

Plant Start

8 The plant starts and stops under the dictates of the general basement time schedule, initially set for 24-hour operation.

9 At the beginning of the time schedule period, the duty extract fan will start and run at its low speed setting.

CO Override

10 Two CO (Carbon Monoxide) sensors are provided in the car park, and should any sensor detect a level of over 31 ppm, the duty fan changed to its high speed mode.

11 Once both CO sensors then detect a fall below 21 ppm, the duty fan returns to its low speed mode.

12 Should any detector sense a CO level over 40 ppm, a critical 'high car park CO level' alarm is raised at the BMS operator's terminal.

Fire Operation

13 On receipt of a fire signal from a local fire interface unit, the duty car

park extract fan is hardwired to hardwired to run at high speed.

14 Upon loss of the fire signal, the fans revert back to their normal mode of operation.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Extract Fan Monitoring & Control

15 The extract fans are arranged for automatic duty/standby operation, with duty selection being changed on a weekly basis, or upon fan failure.

16 An output from the BMS determines which fan of the pair is the duty fan. Another BMS output commands the selected duty fan to run in low speed and a further output commands the selected duty fan to run in high speed. Indicator lamps on the panel fascia show which fan is selected as the duty fan.

17 Each fan is monitored for high speed and low speed running status' via two sets of current sensing relays on all three of its power supply phases.

18 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, is inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

19 If the fan is commanded to run by a fire signal, then the fire signal is taken as the high-speed fan start command.

20 In the event of a fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station. A software flag for the failed fan is set.

21 If the duty fan fails, the duty selection output is changed to make the standby fan the duty fan. The automatic timed duty changeover is inhibited until the failure flag for the failed fan has been reset by an operator.

If with one fan failed, the other fan of the pair fails, an additional alarm indicating both fans are failed is raised, which will only clear when one or both fan failed flags for the pair have been reset. The duty select output will not change after the failure of the second fan.

Control Circuit Monitoring

22 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost eg. Through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator's terminal.

D.1.8 BMS/Security Room Ventilation - System 7

GENERAL

1 Make-up air is supplied to the BMS/Security room by supply fan SF03, consisting of a panel filter, electric heater battery and a constant speed fan. The room is temperature controlled by a dedicated split AC unit that is fed from a local distribution board.

2 Air is extracted from the WC associated with the BMS/Security room and the cleaner's room by a twin axial fan packaged unit EXH08 which operates in a duty/standby manner under the dictates of its own controls.

3 Refer to the mechanical service drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

4 Control equipment and switchgear associated with the supply fan SF03 is housed in Motor Control Centre MCC B/2, and extract fan EXH08 in MCC MCP4..

5 Selector switches and indicator lamps are incorporated on the fascia of Motor Control Centre MCC B/2 as follow

MOTOR CONTROL CENTRE MCC B/2		
TITLE	SWITCH POSITIONS	INDICATION
BMS/SECURITY ROOM SUPPLY FAN SF03	TEST/OFF/AUTO FROST RESET (PUSH-BUTTON)	RUNNING/TRIPPED FROST SHUTDOWN
BMS/SECURITY FAN ELECTRIC HEATER BATTERY	OFF/AUTO/HIGH LIMIT RESET (PUSH BUTTON)	ENABLED/HIGH LIMIT

Selector switches and indicator lamps are incorporated on the fascia of Motor Control Centre MCP4 as follows.

MOTOR CONTROL CENTRE MCP4		
TITLE	SWITCH POSITIONS	INDICATION
BMS/SECURITY ROOM TOILET EXTRACT FAN UNIT EXH08	TEST/OFF/AUTO	POWER ON/FAULT

TEST

6 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

7 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

8 When all of the switches are in there 'auto' positions the following controls strategy apply.

Plant Start

9 Both the supply fan and the extract fan is set for 24 hour operation.

10 It is possible for the supply fan and extract fans to be started and stopped independently via the operator's station graphics.

11 Upon initial start, after a power failure or fire shutdown or startup under operator command, the supply fan starts and the temperature control loops enabled.

Temperature Control

12 The supply air temperature sensor modulates the electric heater battery thyristor via a proportional plus integral control loop, in order to maintain the supply air temperature at its setpoint of 17°C. As there is no cooling available, the supply air temperature will rise above the setpoint in high ambient conditions.

Electric Heater Battery High Limit Shutdown and Supply Fan Interlock

13 The electric heater battery is hardwire interlocked to the supply fan status via a timer such that the electric heater battery can only be enabled for a maximum of 11 seconds with no supply fan running status present.

14 An auto-reset high limit thermostat set to trip at 70°C is positioned downstream of the electric heater battery and hardwired to disable the electric heater battery upon its operation. This interlock also applies to the MCC switches in the 'Test' position.

15 Operation of the high limit thermostat causes the illumination of the 'high limit' lamp on the MCC fascia and raise a high limit alarm at the BMS operator's station. The signal is latched via hardwiring at the MCC, which is only reset by the 'high limit reset' push- button on the MCC fascia.

Plant Shutdown

16 If shutdown by an operator command should the electric heater battery is in operation, it will be disabled and after a 30 second period, the supply fan stopped.

17 If shutdown by an operator command, the extract fan unit will be disabled.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Supply Fan Monitoring & Control

18 The fan is monitored for a running status via a differential pressure switch piped across the fan wired in series with an auxiliary contact on the motor starter.

19 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, is inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

20 In the event of a fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station. The fan turns off and a software flag for the failed fan set. The heater battery control loop will be disabled.

The fans will not re-enter automatic control until the fault has been cleared and the failure flag has been reset by an operator.

Extract Fan Monitoring and Control

21 Whenever the extract fan is required to run, the BMS will energise the contactor providing power to the unit, and the unit will operate under the dictates of its own controls.

22 The packaged fan unit is monitored for a running status via a differential pressure switch piped across the fan wired in series with an auxiliary contact on the unit's power feed contactor.

23 Following a unit enable command, the failure alarm for the fan, derived from a mismatch between the unit enable command and its running status, is inhibited for a period of 30 seconds, allowing time for the duty fan to run up to speed or to automatically change over in the case of duty fan failure.

24 In the event of a total packaged fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station. The unit's power is turned off and a software flag for the failed fan set.

The fans will not re-enter automatic control until the fault has been cleared and the failure flag has been reset by an operator.

25 The packaged unit is monitored for a common fault, which will raise a "duty extract fan failed" alarm at the operator's station

Packaged Air Conditioning Unit Monitoring

26 The BMS monitors the split air conditioning unit for a common fault.

Filter Monitoring

Fire Control

27 The plant is hardwire interlocked with the fire detection system as described under **FIRE CONTROL** (System 999).

28 The interlock for the plant to run-on in order to dissipate residual heat from the heater battery is be overridden under Fire Control.

D.1.9 **Basement Plant West Extract - System 8**

GENERAL

1 The basement is ventilated by extract fan set EXH02, consisting of twin 2-speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

2 Refer to the mechanical service drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

3 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 3.

4 Selector switches and indicator lamps are incorporated on the facia of Motor Control Panel MCP 3 as follows.

MOTOR CONTROL PANEL MCP 3		
TITLE	SWITCH POSITIONS	INDICATION
BASEMENT PLANT WEST EXTRACT FAN NO.1 EXH02/01	HIGH SPEED TEST/LOW SPEED TEST/OFF/AUTO	HIGH SPEED RUNNING/LOW SPEED RUNNING/HIGH SPEED TRIPPED/LOW SPEED TRIPPED
BASEMENT PLANT WEST EXTRACT FAN NO.2 EXH02/02	HIGH SPEED TEST/LOW SPEED TEST/OFF/AUTO	HIGH SPEED RUNNING/LOW SPEED RUNNING/HIGH SPEED TRIPPED/LOW SPEED TRIPPED
BASEMENT PLANT WEST EXTRACT FANS DUTY SELECTION	-	FAN 1 DUTY/FAN 2 DUTY

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in there 'auto' positions the following controls strategy apply.

Plant Start

8 The plant starts and stop under the dictates of the general basement time schedule, initially set for 24-hour operation.

9 At the beginning of the time schedule period, the duty extract fan is started and runs at its low speed setting.

Fire Operation

10 On receipt of a fire signal from a local fire interface unit, the duty extract fan is hardwired to hardwired to run at high speed.

11 Upon loss of the fire signal, the fans revert back to their normal mode of operation.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Extract Fan Monitoring & Control

12 The extract fans are arranged for automatic duty/standby operation, with duty selection being changed on a weekly basis, or upon fan failure.

13 An output from the BMS determines which fan of the pair is the duty fan. Another BMS output commands the selected duty fan to run in low speed. Indicator lamps on the panel fascia shows which fan is selected as the duty fan.

14 Each fan is monitored for a running status via current sensing relays on all three of its power supply phases.

15 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, is inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

16 If the fan is commanded to run by a fire signal, then it will run.

17 In the event of a fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station. A software flag for the failed fan is set.

18 If the duty fan fails, the duty selection output is changed to make the standby fan the duty fan. The automatic timed duty changeover is inhibited until the failure flag for the failed fan has been reset by an operator.

If with one fan failed, the other fan of the pair fails, an additional alarm indicating both fans are failed is raised, which will only clear when one or both fan failed flags for the pair have been reset. The duty select output will not change after the failure of the second fan.

Control Circuit Monitoring

19 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost e.g. through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator's terminal.

D.1.10 **Basement Plant East Extract - System 9**

GENERAL

1 The basement east is ventilated by extract fan set EXH03, consisting of twin 2-speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

2 Refer to the mechanical service drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

3 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 4.

4 Selector switches and indicator lamps are incorporated on the facia of Motor Control Panel MCP 4 as follows.

MOTOR CONTROL PANEL MCP 4		
TITLE	SWITCH POSITIONS	INDICATION
BASEMENT PLANT EAST EXTRACT FAN NO.1 EXH03/01	HIGH SPEED TEST/LOW SPEED TEST/OFF/AUTO	HIGH SPEED RUNNING/LOW SPEED RUNNING/HIGH SPEED TRIPPED/LOW SPEED TRIPPED
BASEMENT PLANT EAST EXTRACT FAN NO.2 EXH03/02	HIGH SPEED TEST/LOW SPEED TEST/OFF/AUTO	HIGH SPEED RUNNING/LOW SPEED RUNNING/HIGH SPEED TRIPPED/LOW SPEED TRIPPED
BASEMENT PLANT EAST EXTRACT FANS DUTY SELECTION	-	FAN 1 DUTY/FAN 2 DUTY

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in there 'auto' positions the following controls strategy apply.

Plant Start

8 The plant starts and stops under the dictates of the general basement time schedule, initially set for 24 hour operation.

9 At the beginning of the time schedule period, the duty extract fan starts and runs at its low speed setting.

Fire Operation

10 On receipt of a fire signal from a local fire interface unit, the duty extract fan will run.

11 Upon loss of the fire signal, the fans revert back to their normal mode of operation.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Extract Fan Monitoring & Control

12 The extract fans are arranged for automatic duty/standby operation, with duty selection being changed on a weekly basis, or upon fan failure.

13 An output from the BMS determines which fan of the pair is the duty fan. Another BMS output commands the selected duty fan to run in low speed. Indicator lamps on the panel fascia shows which fan is selected as the duty fan.

14 Each fan is monitored for a running status via current sensing relays on all three of its power supply phases.

15 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, is inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

16 If the fan is commanded to run by a fire signal, then the fire signal is taken as the high-speed fan start command.

17 In the event of a fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station. A software flag for the failed fan is set.

18 If the duty fan fails, the duty selection output is changed to make the standby fan the duty fan. The automatic timed duty changeover is inhibited until the failure flag for the failed fan has been reset by an operator.

If with one fan failed, the other fan of the pair fails, an additional alarm indicating both fans are failed is raised, which only clears when one or both fan failed flags for the pair have been reset. The duty select output will not change after the failure of the second fan.

Control Circuit Monitoring

19 The BMS monitors the control circuit of each fan for a ‘fan available’ status. Should this status be lost e.g. through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator’s terminal.

D.1.11 Residential Staircase Pressurisation Fans - System 10

GENERAL

1 The residential staircase pressurisation fans are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

2 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

3 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 1.

4 Selector switches and indicator lamps are incorporated on the facia of Motor Control Panel MCP 1 as follows.

MOTOR CONTROL PANEL MCP 1		
TITLE	SWITCH POSITIONS	INDICATION
RESIDENTIAL STAIRCASE PRESSURISATION FAN NO.1 SP03/01	TEST/AUTO	RUNNING/TRIPPED
RESIDENTIAL STAIRCASE PRESSURISATION FAN NO.2 SP03/02	TEST/AUTO	RUNNING/TRIPPED
RESIDENTIAL STAIRCASE PRESSURISATION FANS DUTY SELECTION	FAN No.1/FAN No.2	-

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

AUTO

6 When all of the switches are in their 'auto' positions the following controls strategy apply.

Fire Operation

7 A fire interface unit for systems 10 and 12 are hardwired to command the duty pressurisation fan to run.

8 The duty selector switch determines which fan of the pair is the duty fan.

9 Each fan is monitored for a running status via current sensing relays on all three of its power supply phases.

10 Should a fan running status not be present 11 seconds after the fan was commanded to start, as determined via a timer relay, or should running status then be lost, or should the fan trip, the duty fan is commanded off and the standby fan commanded on via hardwiring.

11 Should the standby fan fail, it remains commanded on until the fire signal is removed.

BMS Monitoring

12 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost e.g. through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator's terminal.

13 The BMS monitors the fans for a common 'failed' status. Upon a fan failure, a critical alarm is raised at the BMS operator's station.

D.1.12 **Office Staircase Pressurisation Fans - System 11**

GENERAL

1 The office staircase pressurisation fans are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

2 Refer to the mechanical service drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

3 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 1.

4 Selector switches and indicator lamps are incorporated on the facia of Motor Control Panel MCP 1 as follows.

MOTOR CONTROL PANEL MCP 1		
TITLE	SWITCH POSITIONS	INDICATION
OFFICE STAIRCASE PRESSURISATION FAN NO.1 SP02/01	TEST/AUTO	RUNNING/TRIPPED
OFFICE STAIRCASE PRESSURISATION FAN NO.2 SP02/02	TEST/AUTO	RUNNING/TRIPPED
OFFICE STAIRCASE PRESSURISATION FANS DUTY SELECTION	FAN No.1/FAN No.2	-

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are

satisfied.

AUTO

6 When all of the switches are in their 'auto' positions the following controls strategy apply.

Fire Operation

7 A fire interface unit for system 11 12 is hardwired to command the duty pressurisation fan to run.

8 The duty selector switch determines which fan of the pair is the duty fan.

9 Each fan is monitored for a running status via current sensing relays on all three of its power supply phases.

10 Should a fan running status not be present 11 seconds after the fan was commanded to start, as determined via a timer relay, or should running status then be lost, or should the fan trip, the duty fan is commanded off and the standby fan commanded on via hardwiring.

11 Should the standby fan fail, it will remain commanded on until the fire signal is removed.

BMS Monitoring

12 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost e.g. through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator's terminal.

13 The BMS monitors the fans for a common 'failed' status. Upon a fan failure, a critical alarm is raised at the BMS operator's station.

D.1.13 **Fire Fighting Staircase Pressurisation Fans - System 12**

GENERAL

1 The firefighting staircase pressurisation fans are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

2 Refer to the mechanical services drawings for equipment locations and the AHU schematics

Motor Control Panel Details

3 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 1.

4 Selector switches and indicator lamps are incorporated on the facia of Motor Control Panel MCP 1 as follows.

MOTOR CONTROL PANEL MCP 1		
TITLE	SWITCH POSITIONS	INDICATION
FIRE FIGHTING STAIRCASE PRESSURISATION FAN NO.1 SP01/01	TEST/AUTO	RUNNING/TRIPPED
FIRE FIGHTING STAIRCASE PRESSURISATION FAN NO.2 SP01/02	TEST/AUTO	RUNNING/TRIPPED
FIRE FIGHTING STAIRCASE PRESSURISATION FANS DUTY SELECTION	FAN No.1/FAN No.2	-

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

AUTO

6 When all of the switches are in there 'auto' positions the following controls strategy apply.

Fire Operation

7 A fire interface unit for system 12 is hardwired to command the duty pressurisation fan to run.

8 The duty selector switch determines which fan of the pair is the duty fan.

9 Each fan is monitored for a running status via current sensing relays on all three of its power supply phases.

10 Should a fan running status not be present 11 seconds after the fan was commanded to start, as determined via a timer relay, or should running status then be lost, or should the fan trip, the duty fan is commanded off and the standby fan commanded on via hardwiring.

11 Should the standby fan fail, it will remain commanded on until the fire signal is removed.

BMS Monitoring

12 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost e.g. through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator's terminal.

13 The BMS monitors the fans for a common `failed' status. Upon a fan failure, a critical alarm is raised at the BMS operator's station.

D.1.14 Workshop Ventilation - System 13

GENERAL

1 Air is supplied to the basement workshop byconstant speed supply fan SF04, and is extracted by EXH02 (refer to System8).

2 Deleted system(s).

MOTOR CONTROL CENTRE MCC B/2		
TITLE	SWITCH POSITIONS	INDICATION
WORKSHOP SUPPLY FAN SF04	TEST/OFF/AUTO	RUNNING/TRIPPED

AUTO

3 When the switch is in the 'auto' position the following controls strategy apply.

Plant Start

4 The fan will start and stop under the dictates of the general basement time schedule, initially set for 24 hour operation.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Supply Fan Monitoring & Control

5 The fan is monitored for a running status via current sensing relays on all three of its power supply phases.

6 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, is inhibited for a period of [20] seconds, allowing time for the fan to run up to speed.

7 In the event of a fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station, the fan is turned off and a software flag for the failed fan set.

8 The automatic operation of the fan will then be inhibited until the failure flag for the fan has been reset by an operator.

Fire Control

9 The plant is hardwire interlocked with the fire detection system as described under **FIRE CONTROL** (System 999).

D.1.15 Boiler Room Combustion Air - System 14

GENERAL

1 Combustion air is supplied to the boiler room by supply fan set SF01, consisting of twin constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper. Associated with SF01 is an electric heater battery, panel filter and LTHW heater battery.

2 Refer to the mechanical service drawings for equipment locations and the AHU schematics.

Motor Control Centre Details

3 Control equipment and switchgear associated with this plant is housed in Motor Control Centre MCP3 B/2.

4 Selector switches and indicator lamps are incorporated on the fascia of Motor Control Centre MCP3 B/2 as follows.

MOTOR CONTROL CENTRE MCC B/2		
TITLE	SWITCH POSITIONS	INDICATION
BOILER COMBUSTION AIR FAN No.1 SF01/01	TEST/OFF/AUTO	RUNNING/TRIPPED
BOILER COMBUSTION AIR FAN No.2 SF01/02	TEST/OFF/AUTO	RUNNING/TRIPPED
BOILER COMBUSTION AIR FANS DUTY SELECTION	FROST RESET (PUSH-BUTTON)	FAN 1 DUTY/FAN 2 DUTYFROST SHUTDOWN
COMBUSTION AIR FANS ELECTRIC HEATER BATTERY	OFF/AUTO HIGH LIMIT RESET (PUSH-BUTTON)	ENABLED/HIGH LIMIT

OFF

5 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a fan failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

6 When all of the switches are in their 'auto' positions the following controls strategy apply.

Plant Start

7 A hardwired common supply "fan running" status signal is hardwired to MCC B/1 to allow an interlock between the combustion air fans and the boilers.

8 The plant starts and stops under the dictates of system 100 via a hardwired "Fans Required" signal from MCC B/1.

9 Upon receipt of a "Fans Required" signal, the plant goes through the following start up procedure.

(i) If the outside air temperature is below the supply air setpoint, then a HEATING DEMAND signal is sent to system 104. The boilers will be inhibited from actually firing until the duty supply fan is running, but any heat left in the boiler circuit will be available.

(ii) If the outside air temperature is below [6]°C, the electric heater battery will be enabled and the duty supply fan will be started at the same time. If no supply fan status is received within 11 seconds, the electric heater battery is immediately disabled.

(iii) Once supply fan status is proved, the temperature control loop is enabled.

(iv) Once the Radiator LTHW Circuit (system 104) is within 1°c of its flow setpoint, the electric heater battery is disabled.

Should the outside air temperature be above 6°C, the electric heater battery remains off at the start.

Temperature Control

10 The supply air temperature sensor modulates the heater battery control valve via a proportional plus integral control loop, in order to maintain the supply air temperature at its setpoint of 17°C. As there is no cooling available, the supply air temperature rises above the setpoint in high ambient conditions.

11 Once the plant is running, should the supply air temperature fall below 6°C, a 'low supply air temperature' alarm is raised at the BMS operator's station and the electric heater battery enabled, and is only disabled and the alarm cleared when the outside air temperature rises above 8°C.

Plant Shutdown

12 At the end of the time schedule period, should the electric heater battery be in operation, it will, be disabled and after a 30 second run-on period, the duty supply fan stopped and the three-port heater battery valve driven to the full flow to bypass position.

Frost Shutdown

13 An averaging element auto-reset frost thermostat is serpentined across the downstream face of the LTHW heater battery. The thermostat is set to trip below 4°C. In the event of the frost thermostat tripping a critical alarm is raised on the BMS operator's station and the duty supply fan has been hardwired to stop. The heater battery valve is driven to the full flow to coil position. After 11 minutes, the heater battery three-port control valve is driven to the full bypass position.

14 The frost thermostat has been hardwired into a latching circuit within the MCC, such that to restart the supply fan, an operator has to push the frost reset button on the MCC fascia, and, provided that the sensed frost condition has cleared, the circuit reset.

15 Resetting of the frost circuit allows the duty supply fan to restart in its normal startup manner, providing it is in an occupied mode. Otherwise, the duty supply fan remains in a shutdown state until next required to run.

Electric Heater Battery High Limit Shutdown and Supply Fan Interlock

16 The electric heater battery is hardwire interlocked to the supply fan status via a timer such that the electric heater battery can only be enabled for a maximum of 11 seconds with no supply fan running status present.

17 An auto-reset high limit thermostat set to trip at 70°C is positioned downstream of the electric heater battery and hardwired to disable the electric heater battery upon its operation. This interlock also applies to the MCC switches in the 'Test' position.

18 Operation of the high limit thermostat causes the illumination of the 'high limit' lamp on the MCC fascia and raise a high limit alarm at the BMS operator's station. The signal is latched via hardwiring at the MCC which only resets by the 'high limit reset' push- button on the MCC fascia.

Heating Demand Signal

19 The heater battery valve sends a HEATING DEMAND signal to system 104 when the valve moves from the full bypass position, without any time delay. The HEATING DEMAND is removed when the valve has closed and remains closed for a period of 10 minutes.

PLANT MONITORING & GENERAL CONTROL INTERLOCKS

Supply Fan Monitoring & Control

20 The supply fans are arranged for automatic duty/standby operation, with duty selection being changed on a weekly basis, or upon fan failure.

21 An output from the BMS determines which fan of the pair is the duty fan. Another BMS output commands the selected duty fan to run. Indicator lamps on the panel fascia shows which fan is selected as the duty fan.

22 Each fan is monitored for a running status via current sensing relays on all three of its power supply phases.

23 Following a fan start command, the failure alarm for the fan, derived from a mismatch between the fan command and its running status, is inhibited for a period of 20 seconds, allowing time for the fan to run up to speed.

24 If the fan is commanded to run by a fire signal, then the fire signal is taken as the fan start command.

25 In the event of a fan failure, as detected by a mismatch between the BMS command to the fan and the fan status, an alarm is raised on the BMS operator's station. A software flag for the failed fan is set.

26 If the duty fan fails, the duty selection output is changed to make the standby fan the duty fan. The automatic timed duty changeover is inhibited until the failure flag for the failed fan has been reset by an operator.

If with one fan failed, the other fan of the pair fails, an additional alarm indicating both fans are failed is raised, which only clears when one or both fan failed flags for the pair have been reset. The duty select output will not change after the failure of the second fan. The heater battery control loop will be disabled and the three-port control valve will be driven to the full flow to bypass position and any HEATING DEMAND signal removed.

Control Circuit Monitoring

27 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost e.g. through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator's terminal.

Filter Monitoring

28 A differential pressure switch, piped across the panel filter, raises an alarm at the BMS operator's station upon sensing a differential pressure indicative of a dirty filter.

Fire Control

29 The plant is hardwire interlocked with the fire detection system as described under **FIRE CONTROL** (System 999).

30 The interlock for the plant to run-on in order to dissipate residual heat from the heater battery is overridden under Fire Control

Plant Restart Sequence

31 The plant is interlocked, through software, to sequentially re-start following:

1. Fire alarm shutdown.
2. Power failure.

D.1.16 East Office Pressurisation Relief Fans - System 20

GENERAL

1 In a fire condition, air supplied to the fire fighting staircase by its pressurisation fan is extracted through the office floors via the east office pressurisation relief fans. These are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

2 The fans extract air through the East office extract riser in parallel with the East office extract AHU. There are two motorised smoke dampers associated with these extract systems which work in an opposed manner for isolation purposes. One isolates the pressurisation relief fans when the AHU is running normally, the other isolates the AHU when the relief fans are running in a fire mode.

3 Refer to the mechanical services drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

4 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 3.

5 Selector switches and indicator lamps are incorporated on the facia of Motor Control Panel MCP 3 as follows.

MOTOR CONTROL PANEL MCP 3		
TITLE	SWITCH POSITIONS	INDICATION
EAST OFFICE PRESSURISATION RELIEF FAN NO.1 EXH04/01	TEST/AUTO	RUNNING/TRIPPED
EAST OFFICE PRESSURISATION RELIEF FAN NO.2 EXH04/02	TEST/AUTO	RUNNING/TRIPPED
EAST OFFICE PRESSURISATION RELIEF FANS DUTY SELECTION	FAN No.1/FAN No.2	-

TEST

6 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the fans to run out of normal automatic control provided all safety interlocks are satisfied.

AUTO

7 When all of the switches are in their 'auto' positions the following controls strategy apply.

Fire Operation

8 A signal from a fire interface unit for system 20 is hardwired to open the pressurisation relief fan isolation smoke damper, and close the AHU isolation smoke damper. Upon receipt of an open status from the pressurisation relief fan damper endswitch cuts out the AHU's, the duty pressurisation relief fan is hardwired to run.

9 The duty selector switch determines which fan of the pair is the duty fan.

10 Each fan is monitored for a running status via current sensing relays on all three of its power supply phases.

11 Should a fan running status not be present 11 seconds after the fan was commanded to start, as determined via a timer relay, or should running status then be lost, or should the fan trip, the duty fan is commanded off and the standby fan commanded on via hardwiring.

12 Should the standby fan fail, it remains commanded on until the fire signal is removed.

13 Once the fire signal is removed, the duty pressurisation relief fan stops, the pressurisation relief fan isolation smoke damper will be closed, and the AHU isolation smoke damper opened.

BMS Monitoring

14 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost e.g. through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator's terminal.

15 The BMS monitors the fans for a common 'failed' status. Upon a fan failure, a critical alarm is raised at the BMS operator's station.

D.1.17 West Office Pressurisation Relief Fans - System 21

GENERAL

1 In a fire condition, air supplied to the office and residential staircases by their pressurisation fans is extracted through the office floors via the West office pressurisation relief fans. These are two constant speed fans operating in a duty/standby manner. Each fan has an associated mechanical non-return damper.

2 The fans extract air through the West office extract riser in parallel with the West office extract AHU. There are two motorised smoke dampers associated with these extract systems which work in an opposed manner for isolation purposes. One isolates the pressurisation relief fans when the AHU is running normally, the other isolates the AHU when the relief fans are running in a fire mode.

3 Refer to the mechanical service drawings for equipment locations and the AHU schematics.

Motor Control Panel Details

4 Control equipment and switchgear associated with this plant is housed in Motor Control Panel MCP 4.

5 Selector switches and indicator lamps are incorporated on the facia of Motor Control Panel MCP 4 as follows.

MOTOR CONTROL PANEL MCP 4		
TITLE	SWITCH POSITIONS	INDICATION
WEST OFFICE PRESSURISATION RELIEF FAN NO.1 EXH05/01	TEST/AUTO	RUNNING/TRIPPED
WEST OFFICE PRESSURISATION RELIEF FAN NO.2 EXH05/02	TEST/AUTO	RUNNING/TRIPPED
WEST OFFICE PRESSURISATION RELIEF FANS DUTY SELECTION	FAN No.1/FAN No.2	-

AUTO

6 When all of the switches are in their 'auto' positions the following controls strategy apply.

Fire Operation

7 A signal from a fire interface unit for system 21 is hardwired to open the pressurisation relief fan isolation smoke damper, and close the AHU isolation smoke damper. Upon receipt of an open status from the pressurisation relief fan damper endswitch, the duty pressurisation relief fan is hardwired to run.

8 The duty selector switch determines which fan of the pair is the duty fan.

9 Each fan is monitored for a running status via current sensing relays on all three of its power supply phases.

10 Should a fan running status not be present 11 seconds after the fan was commanded to start, as determined via a timer relay, or should running status then be lost, or should the fan trip, the duty fan is commanded off and the standby fan commanded on via hardwiring.

11 Should the standby fan fail, it remains commanded on until the fire

signal is removed.

12 Once the fire signal is removed, the duty pressurisation relief fan stops, the pressurisation relief fan isolation smoke damper is closed, and the AHU isolation smoke damper opened.

BMS Monitoring

13 The BMS monitors the control circuit of each fan for a 'fan available' status. Should this status be lost e.g. through the local isolator being turned off and breaking the control circuit, then an appropriate critical alarm is raised at the BMS operator's terminal.

14 The BMS monitors the fans for a common `failed' status. Upon a fan failure, a critical alarm is raised at the BMS operator's station.

D.1.18-D.1.31 Seachange and Trend Integration

1. Each floor is separated into two halfs, by an imaginary line, west and east (compass points). Each side is then termed a zone, so there are two zones per floor. Each zone has a Seachange master zone controller fitted. Each fan coil unit has a Seachange 3 relay unit inside it, this controls fan, heat, coolings. These are software linked to this one master zone controller. A Seachange actuator module is fitted in the smoke control panel and is also software linked to this one master zone controller. Two Seachange lans are used in the building, one east, one west. So although on the west-side of the building all master zone controllers and fan coil units are connected together, they do not talk to each other. This is done by software linking the units together.

2. In operation, when the master zone controller sees it is time to pre-heat, it sends a signal down to boilers to start. It then waits for the boilers to say they are up to temperature. Once this has been received the master zone controller enables the fan coil units. The fans start up and the controller within the fan coil unit determines how much heat is needed. When the master zone controller reaches occupancy it sends a signal via the actuator module, which connects an input into the local smoke damper panel IQ220. This then opens the supply and exhaust isolation dampers. Once these are open then a global command to MCCB2 enables the AHU to run. This command includes information from which floor this signal has come from and hence the volume of air required is known. In an attempt to provide some sort of efficiency a miniumum of 5 units on any one floor must run before a demand for heating or cooling is given.

D.1.18 Lower Ground Floor (East) Controls - System 30

GENERAL

1 The Lower Ground Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 20 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the east mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains 2 No. fire interface units (FIUs) for the control and monitoring of the 2 No. smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/LG/E.

6 Indicator lamps are incorporated on the fascia of Smoke Damper Control Panel SCP/LG/E as follows.

SMOKE DAMPER CONTROL PANEL SCP/LG/E		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/LG/E	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIA L POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel is provided with two same-phase 230/1/10 power feeds in the basement; one essential, one on floor local distribution board non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed will be powered.

8 A four-pole door interlocked main isolator is provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit is provided, which upon loss of non-essential power, switchs to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor

isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program is used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers are commanded open via a common BMS output, and an AHU RUN signal is sent to the east office ventilation AHU (system 1).

14 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the east riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but will power the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers to close. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumes.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within 120 seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are ceiling mounted, airside controlled, fan coil units in the Lower Ground Floor (East) office. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230v ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24v a.c. transformer and any necessary wiring.

25 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs is provided for the Lower Ground Floor (East) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button is provided near the zone controller. Operation of the button outside of the normal time schedule period provides a 60 minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system 1. The button has an integral light which illuminates whilst the time extention is in operation.

30 The fan coil units start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below 12°C, the FCUs are started and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remain closed.

Fan Coil Unit Fire Interlock

35 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the East floor's Smoke Damper Control Panel, the FCUs are commanded to a shutdown state via the communications network.

36 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.19 Ground Floor (North) Controls - System 31

GENERAL

1 The ground floor is different to the other office floors in that it is split North and South, as opposed to East and West.

2 The Ground Floor (North) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 18 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

3 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

4 There is one motorised supply duct smoke damper, and one motorised extract duct smoke damper.

5 A BMS controller for the smoke dampers is located in the east mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

6 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/G/E.

7 Indicator lamps are incorporated on the fascia of Smoke Damper Control Panel SCP/G/E as follows.

SMOKE DAMPER CONTROL PANEL SCP/G/E		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/G/E	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIAL POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

8 The panel is provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed is powered.

9 A four-pole door interlocked main isolator is provided to disconnect both feeds within the panel.

10 The panel normally runs from the non-essential supply. An auto-changeover circuit is provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

11 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

12 With no fire signal present, the smoke dampers are used for floor isolation purposes.

13 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program are used to open and close the dampers.

14 At the beginning of the floor time schedule period, the supply and extract smoke dampers are commanded open via a common BMS output, and an AHU RUN signal is sent to the east office ventilation AHU (system 1).

15 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

16 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the east riser smoke dampers by the fire system.

17 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply damper, but will power the extract damper to the open position.

18 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers to close. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumed.

Fire Alarm System Smoke Damper Monitoring

19 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

20 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within 120 seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

21 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

22 There are ceiling mounted, airside controlled, fan coil units in the Ground Floor (East) office. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

23 The fan motors are 230v ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

24 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller,

return air temperature sensor and any fuses or terminals required.

25 The fan coil unit manufacturer provides a 230/24v a.c. transformer and any necessary wiring.

26 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

27 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

28 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

29 A network based zone controller with integral LCD and adjustment buttons/knobs is provided for the Ground Floor (North) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

30 A time extention push-button is provided near the zone controller. Operation of the button outside of the normal time schedule period provides a [60] minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system 1. The button has an integral light which illuminates whilst the time extention is in operation.

31 The fan coil units start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

32 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

33 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

34 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

35 With the FCUs off, should the floor's associated space temperature sensor sense a value below 12°C, the FCUs are started and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remain closed.

Fan Coil Unit Fire Interlock

36 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the East floor's Smoke Damper Control Panel, the FCUs are commanded to a shutdown state via the communications network.

37 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.20 First Floor (East) Controls - System 32

GENERAL

1 The First Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 17 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the east mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/1/E.

6 Indicator lamps are incorporated on the fascia of Smoke Damper Control Panel SCP/1/E as follows.

SMOKE DAMPER CONTROL PANEL SCP/1/E		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/1/E	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIAL POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel is provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed powered.

8 A four-pole door interlocked main isolator is provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit is provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program is used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers are commanded open via a common BMS output, and an AHU RUN signal is sent to the east office ventilation AHU (system 1).

14 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which break the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the east riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but powers the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 1. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumes.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within 120 seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 17 ceiling mounted, airside controlled, fan coil units in the First Floor (East) office, referenced 1/19 to 1/31. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24v a.c. transformer and any necessary wiring.

25 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs is provided for the First Floor (East) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button is provided near the zone controller. Operation of the button outside of the normal time schedule period provides a [60] minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system 1. The button has an integral light which illuminates whilst the time extention is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units are initially placed in-groups for master/slave operation. The groups are as follows:

31 The fan coil units are started and stopped under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

32 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

33 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

34 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

35 With the FCUs off, should the floor's associated space temperature sensor sense a value below 12°C, the FCUs are started and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remain closed.

Heat Meter Monitoring

36 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

37 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

38 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the East floor's Smoke Damper Control Panel, the FCUs are commanded to a shutdown state via the communications network.

39 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.21 Second Floor (East) Controls - System 33

GENERAL

1 The Second Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the east mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers are housed in Smoke Damper Control Panel SCP/2/E.

6 Indicator lamps are incorporated on the fascia of Smoke Damper Control Panel SCP/2/E as follows.

SMOKE DAMPER CONTROL PANEL SCP/2/E		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/2/E	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIA L POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel is provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed is powered.

8 A four-pole door interlocked main isolator is provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit is provided, which upon loss of non-essential power, switchs to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program will be used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers are commanded open via a common BMS output, and an AHU RUN signal is sent to the east office ventilation AHU (system 1).

14 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the east riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but powers the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 1. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumes.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within 120 seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 19 ceiling mounted, airside controlled, fan coil units in the Second Floor (East) office, referenced 2/20 to 2/38. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24V a.c. transformer and any necessary wiring.

25 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs is provided for the Second Floor (East) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button is provided near the zone controller. Operation of the button outside of the normal time schedule period provides a [60] minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system 1. The button has an integral light which illuminates whilst the time extention is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units start and stop under the dictates of an optimum start routine. The optimum start will provide both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below 12°C, the FCUs are started and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs switch off and the HEATING DEMAND signal removed . The floor isolation dampers remain closed

Heat Meter Monitoring

35 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

36 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

37 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the East floor's Smoke Damper Control Panel, the FCUs are commanded to a shutdown state via the communications network.

38 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.22 Third Floor (East) Controls - System 34

GENERAL

1 The Third Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the east mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/3/E.

6 Indicator lamps are incorporated on the fascia of Smoke Damper Control Panel SCP/3/E as follows.

SMOKE DAMPER CONTROL PANEL SCP/3/E		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/3/E	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIAL POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel is provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed is powered.

8 A four-pole door interlocked main isolator is provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit is provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program is used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers are commanded open via a common BMS output, and an AHU RUN signal is sent to the east office ventilation AHU (system 1).

14 At the end of the floor time schedule period, the supply and extract smoke dampers commanded closed and the AHU RUN signal is removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the east riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but will power the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 1. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumes.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within 120 seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 19 ceiling mounted, airside controlled, fan coil units in the Third Floor (East) office, referenced 3/20 to 3/38. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24V a.c. transformer and any necessary wiring.

25 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs is provided for the Third Floor (East) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button is provided near the zone controller. Operation of the button outside of the normal time schedule period provides a [60] minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system 1. The button has an integral light which illuminates whilst the time extention is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units are started and stopped under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below [12]°C, the FCUs are started and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above [16]°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remains closed.

Heat Meter Monitoring

35 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

36 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

37 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the East floor's Smoke Damper Control Panel, the FCUs are commanded to a shutdown state via the communications network.

38 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.23 Fourth Floor (East) Controls - System 35

GENERAL

1 The Fourth Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the east mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers are housed

in Smoke Damper Control Panel SCP/4/E.

6 Indicator lamps are incorporated on the fascia of Smoke Damper Control Panel SCP/4/E as follows.

SMOKE DAMPER CONTROL PANEL SCP/4/E		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/4/E	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIAL POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel is provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed is powered.

8 A four-pole door interlocked main isolator is provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit is provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program is used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers is commanded open via a common BMS output, and an AHU RUN signal is sent to the east office ventilation AHU (system 1).

14 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the east riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but powers the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 1. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resume.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within 120 seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 24 ceiling mounted, airside controlled, fan coil units in the Fourth Floor (East) office, referenced 4/21 to 4/48. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24V a.c. transformer and any necessary wiring.

25 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs is provided for the Fourth Floor (East) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button is provided near the zone controller. Operation of the button outside of the normal time schedule period provides a 60 minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system

30 The button has an integral light which illuminates whilst the time extension is in operation.

Fan Coil Units - Temperature Control

31 The fan coil units start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

32 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

33 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

34 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

35 With the FCUs off, should the floor's associated space temperature sensor sense a value below 12°C, the FCUs will start and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remain closed.

Heat Meter Monitoring

36 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

37 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

38 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the East floor's Smoke Damper Control Panel, the FCUs are commanded to a shutdown state via the communications network.

39 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.24 Fifth Floor (East) Controls - System 36

GENERAL

1 The Fifth Floor (East) office has its air supplied and extracted by AHU01 (System 1). The floor can be isolated from the East office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 11 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the east mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/5/E.

6 Indicator lamps are incorporated on the fascia of Smoke Damper Control Panel SCP/5/E as follows.

SMOKE DAMPER CONTROL PANEL SCP/5/E		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/5/E	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIA L POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel is provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed is powered.

8 A four-pole door interlocked main isolator is provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit is provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program are used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers is commanded open via a common BMS output, and an AHU RUN signal is sent to the east office ventilation AHU (system 1).

14 At the end of the floor time schedule period, the supply and extract smoke dampers is commanded closed and the AHU RUN signal is removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the east riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but powers the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 1. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resume.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within 120 seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 11 ceiling mounted, airside controlled, fan coil units in the Fifth Floor (East) office, referenced 1/12 to 1/22. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24 va.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24 vma.c. transformer and any necessary wiring.

25 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs is provided for the Fifth Floor (East) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button is provided near the zone controller. Operation of the button outside of the normal time schedule period will provide a 60 minute extension of the floor FCU operation, keeps the floor isolation dampers open and send an AHU RUN signal to system 1. The button has an integral light, which illuminates whilst the time extension is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units are started and stopped under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals are removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below 12°C, the FCUs are started and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs switch off and the HEATING DEMAND signal removed . The floor isolation dampers remain closed.

Heat Meter Monitoring

35 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

36 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

37 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the East floor's Smoke Damper Control Panel, the FCUs commanded to a shutdown state via the communications network.

38 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.25 Lower Ground Floor (West) Controls - System 37

GENERAL

1 The Lower Ground Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 20 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the west mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/LG/W.

6 Indicator lamps are incorporated on the fascia of Smoke Damper Control Panel SCP/LG/W as follows.

SMOKE DAMPER CONTROL PANEL SCP/LG/W		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/LG/W	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIAL POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel is provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed will be powered.

8 A four-pole door interlocked main isolator is provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit is provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program is used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers are commanded open via a common BMS output, and an AHU RUN signal is sent to the west office ventilation AHU (system 2).

14 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the west riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but powers the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 2. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumes.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within [120] seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 20 ceiling mounted, airside controlled, fan coil units in the Lower Ground Floor (West) office, referenced LG/1 to LG/20. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24V a.c. transformer and any necessary wiring.

25 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs has been provided for the Lower Ground Floor (West) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button has been provided near the zone controller. Operation of the button outside of the normal time schedule period will provide a [60] minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system 2. The button has an integral light which illuminates whilst the time extention is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below [12]°C, the FCUs will start and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs will switch off and the HEATING DEMAND signal will be removed. The floor isolation dampers will remain closed.

Heat Meter Monitoring

35 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

36 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

37 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the West floor's Smoke Damper Control Panel, the FCUs will be commanded to a shutdown state via the communications network.

38 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, will resume.

D.1.26 Ground Floor (South) Controls - System 38

GENERAL

1 The ground floor is different to the other office floors in that it is split North and South, as opposed to East and West.

2 The Ground Floor (South) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 17 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

3 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

4 There is one motorised supply duct smoke damper, and one motorised extract duct smoke damper.

5 A BMS controller for the smoke dampers are located in the west mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel contains fire interface units (FIUs)) for the control and monitoring of the smoke dampers in a fire condition.

6 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/G/E.

7 Indicator lamps have been incorporated on the fascia of Smoke Damper Control Panel SCP/G/E as follows.

SMOKE DAMPER CONTROL PANEL SCP/G/E		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/G/E	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIAL POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

8 The panel has been provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed is powered.

9 A four-pole door interlocked main isolator has been provided to disconnect both feeds within the panel.

10 The panel normally runs from the non-essential supply. An auto-changeover circuit has been provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

11 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

12 With no fire signal present, the smoke dampers are used for floor isolation purposes.

13 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program will be used to open and close the dampers.

14 At the beginning of the floor time schedule period, the supply and extract smoke dampers will be commanded open via a common BMS output, and an AHU RUN signal will be sent to the west office ventilation AHU (system 2).

15 At the end of the floor time schedule period, the supply and extract smoke dampers will be commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

16 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal which breaks the power feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the west riser smoke dampers by the fire system.

17 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply damper, but powers the extract damper to the open position.

18 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 2. The dampers will remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers will be driven to their desired position dependant upon the floor time schedule and normal operation will resume.

Fire Alarm System Smoke Damper Monitoring

19 The extract smoke damper are monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

20 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within [120] seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

21 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

22 There are 17 ceiling mounted, airside controlled, fan coil units in the Ground Floor (South) office, referenced G/1 to G/17. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

23 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

24 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

25 The fan coil unit manufacturer provides a 230/24V a.c. transformer and any necessary wiring.

26 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

27 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

28 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

29 A network based zone controller with integral LCD and adjustment buttons/knobs has been provided for the Ground Floor (South) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

30 A time extention push-button has been provided near the zone controller. Operation of the button outside of the normal time schedule period provides a [60] minute extension of the floor FCU operation, will keep the floor isolation dampers open and send an AHU Run signal to system 2. The button has an integral light which illuminates whilst the time extension is in operation.

Fan Coil Units - Temperature Control

31 The fan coil units will start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

32 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

33 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

34 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

35 With the FCUs off, should the floor's associated space temperature sensor sense a value below [12]°C, the FCUs will start and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remain closed.

Heat Meter Monitoring

36 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

37 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

38 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the South floor's Smoke Damper Control Panel, the FCUs will be commanded to a shutdown state via the communications network.

39 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.27 First Floor (West) Controls - System 39

GENERAL

1 The First Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 18 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the west mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/1/W.

6 Indicator lamps have been incorporated on the fascia of Smoke Damper Control Panel SCP/1/W as follows.

SMOKE DAMPER CONTROL PANEL SCP/1/W		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/1/W	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIAL POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel has been provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed will be powered.

8 A four-pole door interlocked main isolator has been provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit is provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program is used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and

Extract smoke dampers are commanded open via a common BMS output, and an AHU RUN signal sent to the west office ventilation AHU (system 2).

14 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the west riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay will operate, which will override the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but powers the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 2. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers will be driven to their desired position dependant upon the floor time schedule and normal operation resumes.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within [120] seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 18 ceiling mounted, airside controlled, fan coil units in the First Floor (West) office, referenced 1/1 to 1/18. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24 va.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer will provide a 230/24V a.c. transformer and any necessary wiring.

25 The Trade Contractor will provide detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller will use the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system are located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs has been provided for the First Floor (West) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button has been provided near the zone controller. Operation of the button outside of the normal time schedule period provides a 60 minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system 2. The button has an integral light which illuminates whilst the time extention is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans turn off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals are removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below 12°C, the FCUs will start and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs will switch off and the HEATING DEMAND signal will be removed. The floor isolation dampers will remain closed.

Heat Meter Monitoring

35 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

36 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

37 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the West floor's Smoke Damper Control Panel, the FCUs commanded to a shutdown state via the communications network.

38 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.28 Second Floor (West) Controls - System 40

GENERAL

1 The Second Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the west mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/2/W.

6 Indicator lamps have been incorporated on the fascia of Smoke Damper Control Panel SCP/2/W as follows.

SMOKE DAMPER CONTROL PANEL SCP/2/W		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/2/W	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIA L POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel has been provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed will be powered.

8 A four-pole door interlocked main isolator has been provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit has been provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program will be used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers are commanded open via a common BMS output, and an AHU RUN signal sent to the west office ventilation AHU (system 2).

14 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the west riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but will power the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay will cause the BMS to command the dampers closed and to remove the AHU RUN signal from system 2. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumes.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within [120] seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 19 ceiling mounted, airside controlled, fan coil units in the Second Floor (West) office, referenced 2/1 to 2/19. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24V a.c. transformer and any necessary wiring.

25 The Trade Contractor will provide detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller will use the Echelon field bus for communications. The controller will be capable of operating in both 'master' and 'slave' modes and will have the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs has been provided for the Second Floor (West) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button has been provided near the zone controller. Operation of the button outside of the normal time schedule period provides a [60] minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system 2. The button has an integral light which illuminates whilst the time extention is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units will start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals are removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below [12]°C, the FCUs will start and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remain closed.

Heat Meter Monitoring

35 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

36 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

37 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the West floor's Smoke Damper Control Panel, the FCUs commanded to a shutdown state via the communications network.

38 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resume.

D.1.29 Third Floor (West) Controls - System 41

GENERAL

1 The Third Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the west mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/3/W.

6 Indicator lamps have been incorporated on the fascia of Smoke Damper Control Panel SCP/3/W as follows.

SMOKE DAMPER CONTROL PANEL SCP/3/W		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/3/W	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIA L POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel has been provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed will be powered.

8 A four-pole door interlocked main isolator will be provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit has been provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program is used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers are commanded open via a common BMS output, and an AHU RUN signal sent to the west office ventilation AHU (system 2).

14 At the end of the floor time schedule period, the supply and extract smoke dampers commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the west riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but powers the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 2. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumes.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within 120 seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 19 ceiling mounted, airside controlled, fan coil units in the Third Floor (West) office, referenced 3/1 to 3/19. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24v a.c. transformer and any necessary wiring.

25 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs is provided for the Third Floor (West) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button has been provided near the zone controller. Operation of the button outside of the normal time schedule period provides a [60] minute extension of the floor FCU operation, keeps the floor isolation dampers open and send an AHU RUN signal to system 2. The button has an integral light which illuminates whilst the time extention is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units will start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below [12]°C, the FCUs will start and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above [16]°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remain closed.

Heat Meter Monitoring

35 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

36 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

37 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the West floor's Smoke Damper Control Panel, the FCUs are commanded to a shutdown state via the communications network.

38 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resumed.

D.1.30 Fourth Floor (West) Controls - System 42

GENERAL

1 The Fourth Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 19 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical services drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the west mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/4/W.

6 Indicator lamps have been incorporated on the fascia of Smoke Damper Control Panel SCP/4/W as follows.

SMOKE DAMPER CONTROL PANEL SCP/4/W		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/4/W	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIAL POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel has been provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed will be powered.

8 A four-pole door interlocked main isolator has been provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit has been provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program is used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers commanded open via a common BMS output, and an AHU RUN signal is sent to the west office ventilation AHU (system 2).

14 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the west riser

smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but powers the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 2. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumed.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within 120 seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 19 ceiling mounted, airside controlled, fan coil units in the Fourth Floor (West) office, referenced 4/1 to 4/19. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24V a.c. transformer and any necessary wiring.

25 The Trade Contractor will provide detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs has been provided for the Fourth Floor (West) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button has been provided near the zone controller. Operation of the button outside of the normal time schedule period provides a [60] minute extension of the floor FCU operation, keeping the floor isolation dampers open and send an AHU RUN signal to system 2. The button has an integral light which illuminates whilst the timeextension is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units will start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans will be turned off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below [12]°C, the FCUs will start and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above 16°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remains closed.

Heat Meter Monitoring

35 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

36 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

37 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the West floor's Smoke Damper Control Panel, the FCUs are commanded to a shutdown state via the communications network.

38 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resumed.

D.1.31 Fifth Floor (West) Controls - System 43

GENERAL

1 The Fifth Floor (West) office has its air supplied and extracted by AHU02 (System 2). The floor can be isolated from the West office supply and extract air risers by means of motorised smoke dampers. Air to the floor is supplied via the back of 11 ceiling-mounted fan coil units. The fan coil units are all of the airside control type.

2 Refer to the mechanical service drawings for equipment locations and the office ventilation schematic.

Smoke Damper Control Panel

3 There are two motorised supply duct smoke dampers, and one motorised extract duct smoke damper.

4 A BMS controller for the smoke dampers is located in the west mechanical riser near the smoke dampers within a control panel dedicated for this purpose. The control panel also contains fire interface units (FIUs) for the control and monitoring of the smoke dampers in a fire condition.

5 Control equipment associated with the smoke dampers is housed in Smoke Damper Control Panel SCP/5/W.

6 Indicator lamps have been incorporated on the fascia of Smoke Damper Control Panel SCP/5/W as follows.

SMOKE DAMPER CONTROL PANEL SCP/5/W		
TITLE	SWITCH POSITIONS	INDICATION
SMOKE DAMPER CONTROL PANEL SCP/5/W	-	NON-ESSENTIAL POWER HEALTHY/ESSENTIAL POWER HEALTHY/24V CONTROL CIRCUIT HEALTHY

7 The panel has been provided with two same-phase 230/1/10 power feeds; one essential and one non-essential. In normal conditions both feeds are energised. In a power failure condition with the generator running, only the essential feed is powered.

8 A four-pole door interlocked main isolator has been provided to disconnect both feeds within the panel.

9 The panel normally runs from the non-essential supply. An auto-changeover circuit has been provided, which upon loss of non-essential power, switches to the essential power supply. Upon resumption of non-essential power, the circuit changes back to the non-essential supply.

10 The interface circuits to the FIU relay modules are at a maximum voltage of 24V ac or dc.

Smoke Damper Control - Normal

11 With no fire signal present, the smoke dampers are used for floor isolation purposes.

12 The floor's FCUs are started and stopped under the dictates of the floor optimum start program. The occupied and unoccupied periods of the time schedule associated with the optimum start program used to open and close the dampers.

13 At the beginning of the floor time schedule period, the supply and extract smoke dampers is commanded open via a common BMS output, and an AHU RUN signal is sent to the west office ventilation AHU (system 2).

14 At the end of the floor time schedule period, the supply and extract smoke dampers are commanded closed and the AHU RUN signal removed.

Smoke Damper Control - Fire

15 The smoke dampers are hardwire interlocked with two fire interface relays. The first relay provides a smoke damper close signal, which breaks the power, feed to the supply and extract smoke dampers, causing them to spring closed. This signal is sent to all the west riser smoke dampers by the fire system.

16 If the floor is the floor where fire has been detected, then the second fire interface relay operates, which overrides the action of the first relay. Operation of this relay breaks the power feed to the supply dampers, but powers the extract damper to the open position.

17 The BMS monitors the status of both the fire interface relays. Operation of either fire interface relay causes the BMS to command the dampers closed and to remove the AHU RUN signal from system 2. The dampers remain commanded shut until the fire signals have both been removed and a global FIRE SHUTDOWN RESET signal has been received, after which the dampers are driven to their desired position dependant upon the floor time schedule and normal operation resumed.

Fire Alarm System Smoke Damper Monitoring

18 The extract smoke damper is monitored for an open and closed status by the fire system via fire interface unit input modules located within the panel. The extract damper is monitored for its open and closed status via its damper endswitches.

BMS Smoke Damper Monitoring

19 The smoke dampers are monitored for a common open signal by the BMS via actuator endswitches wired in series. If, with no fire signal present, the dampers are commanded open and no open endswitch signal is received within [120] seconds, or the dampers are being commanded open and the open indication is subsequently lost, then an alarm is raised at the BMS operator's station.

20 The BMS monitors the status of both the fire interface relays and inhibits the damper monitoring alarm upon operation of either relay.

Fan Coil Units - General

21 There are 11 ceiling mounted, airside controlled, fan coil units in the Fifth Floor (West) office, referenced 1/1 to 1/11. All the fan coil units have an integral fan, heating coil, cooling coil and damper actuator.

22 The fan motors are 230V ac single phase, and the damper actuators are 24v a.c. units requiring a 0-10v d.c control signal.

23 The Trade Contractor provides free issue to the fan coil unit manufacturer for fitting to works; an intelligent unitary controller, return air temperature sensor and any fuses or terminals required.

24 The fan coil unit manufacturer provides a 230/24V-a.c. transformer and any necessary wiring.

25 The Trade Contractor provides detailed wiring diagrams and cabling specifications for the fan coil manufacturer's use.

26 The intelligent unitary controller uses the Echelon field bus for communications. The controller is capable of operating in both 'master' and 'slave' modes and has the capability of having a room temperature sensor with remote setpoint adjustment added at a later date.

27 Any network interface device required between the floor FCU controllers and the main building BMS system is located in the floor's electrical riser.

28 A network based zone controller with integral LCD and adjustment buttons/knobs is provided for the Fifth Floor (West) which allows a user to view and adjust the floor's time schedule and the zone temperature setpoints. The controller allows the reconfiguration of the associated FCUs into a greater or lesser number of zones at a later date.

29 A time extention push-button has been provided near the zone controller. Operation of the button outside of the normal time schedule period provides a 60 minute extension of the floor FCU operation keeps the floor isolation dampers open and send an AHU RUN signal to system 2. The button has an integral light which illuminates whilst the time extention is in operation.

Fan Coil Units - Temperature Control

30 The fan coil units will start and stop under the dictates of an optimum start routine. The optimum start provides both heating and cooling optimisation. The routine uses the global outside air value and the floor's associated space temperature sensor value to start the fan coil units in either a heating or cooling mode in order to achieve the temperature setpoint at the start of the associated time schedule period.

31 Once started, the master unit of each group modulates the FCU dampers in parallel via a proportional control loop in order to maintain a return air setpoint of [21]°C ± [1.1]K

32 At the end of the associated time schedule period, the FCU fans are turned off and the dampers positioned in their mid-position (full bypass).

33 Each FCU group generates a HEATING DEMAND signal for system 101 if the group's dampers are open to the heating coils, and a COOLING DEMAND signal for system 201 if the group's dampers are open to the cooing coils. With the dampers in the full bypass position or else when the FCUs are off, the demand signals removed.

Fan Coil Units - Fabric Protection

34 With the FCUs off, should the floor's associated space temperature sensor sense a value below [12]°C, the FCUs will start and run in a heating mode, and a HEATING DEMAND signal generated, until the space temperature rises above [16]°C, at which point the FCUs switch off and the HEATING DEMAND signal removed. The floor isolation dampers remain closed.

Heat Meter Monitoring

35 Two heat meters for each floor, one for the CHW and one for the LTHW for the FCUs, are monitored and the kWh pulses from each meter logged.

36 The values from the heat meters are available for use in Tennant Billing calculations by the main BMS system.

Fan Coil Unit Fire Interlock

37 Upon receipt of either the 'both smoke dampers close' or the 'extract smoke damper open' fire signals at the West floor's Smoke Damper Control Panel, the FCUs are commanded to a shutdown state via the communications network.

38 Upon loss of both fire signals and once a subsequent global FIRE SHUTDOWN RESET signal has been received, normal FCU operation, dependant upon the floor time schedule, resumed.

D.1.32 Primary Boiler Plant - System 100

GENERAL

1 The primary heating circuit is a staged constant volume system and consists of two banks of modular gas fired boilers, with four modules in each bank, and two-speed duty/standby primary circulating pumps. Each bank of boilers is controlled by its own sequencer. Associated with the boiler plant primary circuit is a packaged pressurisation unit. Combustion air is provided by fan set SF01 (refer to System 14).

2 The secondary heating system consists of two constant volume and two compensated circuits. Refer to system 101, 102, 103 and 104 narratives for details.

3 Refer to the mechanical service drawings for equipment locations and the schematics.

Motor Control Centre Details

4 Control equipment and switchgear associated with the heating plant is housed in MCP3 and MCC B/1.

5 Selector switches and indicator lamps have been incorporated on the facia of Motor Control Centre MCP3 and MCC B/1 as follows.

MOTOR CONTROL CENTRE MCC B/1		
TITLE	SWITCH POSITION	INDICATION
PRIMARY HEATING PUMP No.1 100/PPC/001	HIGH SPEED TEST/LOW SPEED TEST/OFF/AUTO	HIGH SPEED RUNNING/LOW SPEED RUNNING/HIGH SPEED TRIPPED/LOW SPEED TRIPPED
PRIMARY HEATING PUMP No.2 100/PPC/002	HIGH SPEED TEST/LOW SPEED TEST/OFF/AUTO	HIGH SPEED RUNNING/LOW SPEED RUNNING/HIGH SPEED TRIPPED/LOW SPEED TRIPPED
MODULAR BOILER BANK No.1 100/BRM/001	OFF/AUTO	POWER ON/COMMON LOCKOUT/COMMON HIGH LIMIT
MODULAR BOILER BANK No.2 100/BRM/002	OFF/AUTO	POWER ON/COMMON LOCKOUT/COMMON HIGH LIMIT
HEATING PRESSURISATION UNIT 100/PRU/001	-	POWER ON/FAULT/HIGH PRESSURE/LOW PRESSURE
BOILER ROOM SAFETY CIRCUIT	-	BOILER ROOM SAFETY CIRCUIT ACTIVATED
MAIN GAS VALVE	SAFETY CIRCUIT RESET (PUSH BUTTON)	GAS VALVE CLOSED/GAS VALVE OPEN
GAS DETECTION UNIT	-	GAS DETECTED/GAS SENSOR FAULT

TEST

6 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the drive to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

7 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised has to be cleared before the plant will run again under automatic control.

AUTO

8 When all of the selector switches are in their 'auto' positions the following controls strategy will apply.

Boiler Controls and Interlocks

9 The boilers are selected for a low temperature hot water (LTHW) flow temperature of 82°C and a return temperature of 70°C. Each boiler module has a high and low fire capacity.

10 Each bank of four modules is controlled by its own packaged sequencer. Each sequencer comes complete with all necessary control sensors. The sequencers are individually enabled and disabled by signals from the BMS.

11 An integral high limit thermostat located in each boilers module's flow outlet pipework has been provided with each boiler. Each high limit thermostat shuts down its associated boiler module, via a hardwired interlock, when the measured flow temperature reaches [94]°C.

12 A boiler 'lockout' alarm also switches off the faulty boiler module.

13 Each boiler module's control panel provides two volt-free contact signals, which indicates boiler 'lockout', and 'high limit' conditions.

14 Each bank of four modules is monitored for a common 'lockout' condition, and an indication is provided on the facia of MCC B/1 and an alarm raised on the BMS operator's station for each bank when a boiler module shuts down in 'lockout' condition.

15 Each bank of four modules is monitored for a common 'high limit' condition, and an indication provided on the facia of MCC B/1 and an alarm raised on the BMS operator's station for each bank when a boiler module shuts down in 'high limit' condition.

16 A high limit thermostat, located in the primary circuit common flow header, will on sensing a temperature of 99°C or above, switch off both banks of boilers via a hard wired interlock and raise an alarm on the BMS operator's station. This thermostat will be of the hand re-set type.

17 Whenever the boilers are required to run, a hardwired signal is sent to MCP3 to request the operation of system 14, the boiler room make-up air fans. A hardwired "fan running" signal from MCP3 must be received before the boiler sequencers are enabled. Loss of the fan running signal causes the immediate disabling of the boiler sequencers.

18 When the boilers are require to operate, the boiler sequencer for a bank of modules only be enabled to operate when all of the following hard wired interlocks are satisfied.

(i) The duty primary pump is running and flow is proven through the bank as detected by an auxiliary contact on the motor starter wired in series with a differential pressure switch measuring across the pump and the flow proving differential pressure switch measuring across an orifice plate located in the bank's discharge pipework. Note: the bank's flow differential pressure switches are set to break at a pressure associated with a flow of 70% of the design volume.

(ii) The flow isolation valve for the module bank is open as confirmed by an endswitch on the isolation valve's actuator.

(iii) The safety circuit is healthy (panic buttons, gas detected, fire condition, etc.)

(iv) System pressure not out of limits.

(v) The gas solenoid valve opens, as proved by an actuator open end switch.

(vi) The common flow header high temperature cut out is in a healthy state.

(vii) The hardwired "fan running" signal from MCP3 is present.

Primary Plant Enable

Summer/Winter Mode Selection

19 The primary boiler plant operates in two modes:- summer and winter.

20 The plant is set to operate in a summer mode when the outside air temperature is above [17]°C and the only SECONDARY HEATING DEMAND signals are from either the DHWS system (system 103) and/or the radiator LTHW circuit (system 104).

21 The plant is set to operate in a winter mode when either the outside air temperature is [16]°C or below, or else the outside air temperature is above [16]°C and there are SECONDARY HEATING DEMAND signals present from the FCU secondary LTHW circuit (system 101) and/or the AHU secondary LTHW circuit (system 102).

22 For intermediate conditions, the plant operates in its last selected mode.

23 Mode selection also occurs when the plant is in a shutdown state.

Summer Operation

24 In the summer mode, the duty primary heating pump runs at its low speed setting and the two banks of modules run in a duty/standby mode, with the standby bank isolated via its associated two-port isolating valve.

25 Bank duty selection is via a rotational point in the BMS, with duty selection taking place on a weekly basis when the plant is off. The standby bank has its associated isolation valve driven closed and the duty bank has its isolation valve driven open. The valves remain in these positions regardless of whether the primary pump is running or not.

26 The boiler system has been enabled to start by any of the following signals:

(i) A secondary heating demand signal from the DHWS calorifier LTHW circuit system 103.

(ii) A secondary heating demand signal from the radiator LTHW circuit system 104.

27 On receipt of a start signal from one of the above, the duty heating primary pump will start in low speed.

28 Once the duty pump's running status has been proven, the sequencer for the duty boiler will be enabled provided all the interlocks stated in **Boiler Controls and Interlocks** are satisfied.

29 Once enabled the bank of modules operate under the command of its own its own sequencer to maintain its flow temperature at set point.

30 Upon receipt of a primary pump running status, via motor starter auxiliary contacts and differential pressure switch measuring across the pump, a 'PRIMARY PUMP RUNNING' signal is sent to systems 103 and 104 to enable the secondary pump(s) to be started.

Winter Mode Operation

31 In the winter mode, the duty primary heating pump runs at its high speed setting and the two banks of modules will both run, with their associated two-port bank isolating valves open. The isolating valves remain open regardless of whether the primary pump is running or not.

32 The boiler system is enabled to start by any of the following signals:

(i) A secondary heating demand signal from the FCU secondary LTHW circuit system 101

(ii) A secondary heating demand signal from the AHU secondary LTHW circuit system 102.

(iii) A secondary heating demand signal from the DHWS calorifier LTHW circuit system 103.

(iv) A secondary heating demand signal from the radiator LTHW circuit system 104.

(v) A stage 2 frost protection command

33 On receipt of a start signal from one of the above, the duty heating

primary pump is started in high speed.

34 Once the duty pump's running status has been proven, the sequencers for both banks of boilers has been enabled provided all the interlocks stated in **Boiler Controls and Interlocks** are satisfied.

35 Once enabled the bank of modules operate under the command of their own sequencers to maintain the flow temperature at set point.

36 Upon receipt of a primary pump running status, via motor starter auxiliary contacts and differential pressure switch measuring across the pump, a 'PRIMARY PUMP RUNNING' signal is sent to systems 101, 102, 103 and 104 to enable the secondary pump(s) to be started as required.

Summer/Winter Changeover

37 Should the mode of operation change from summer to winter operation whilst the boiler plant is running, the following sequence will be followed:

38 The duty boiler sequencer is disabled. Following a 30 second time delay, the standby module bank isolation valve is driven open.

39 Once the isolation valve open endswitch has made, the duty primary pump commanded to run at its high speed.

40 Once the duty pump's high speed running status has been proven, the sequencers for both banks of boilers are enabled provided all the interlocks stated in **Boiler Controls and Interlocks** are satisfied.

Winter/Summer Changeover

41 Should the mode of operation change from winter to summer operation whilst the boiler plant is running, the following sequence will be followed:

42 Both boiler sequencers will be disabled.

43 Following a 60 second time delay, the duty primary pump will be commanded to run at its low speed.

44 Once the duty pump's low speed running status has been proven, the standby boiler bank isolation valve driven closed.

45 Following a 120 second time delay, the sequencer for the duty bank of boilers will be enabled provided all the interlocks stated in **Boiler Controls and Interlocks** are satisfied.

Plant Shutdown

46 Upon loss of all SECONDARY HEATING DEMAND signals, the boiler sequencer(s) are disabled.

47 The duty primary pump runs on for a period of [1] minutes before stopping, and the 'PRIMARY PUMP RUNNING' signal is then be removed. The isolation valve positions are not affected by the plant shutting down.

Frost Protection

48 When the plant is shutdown, the plant operates in two stages for building frost protection purposes.

Stage 1

49 If the outside air temperature sensor value falls to 1°C or less, the lead primary circuit pump is started. In addition, the duty secondary circuit pumps of systems 102 and 104 is started. A 'STAGE 1 FROST PROTECTION OPERATING' indication is provided on all associated heating plant graphics.

Stage 2

50 The common primary return water temperature is monitored by the BMS. When the boiler plant is operating in a stage 1 frost protection mode, should the common return water temperature fall to 11°C or below, then the boiler system operates as described below:

51 The boilers are enabled as described under **Winter Operation**.

52 'STAGE 2 FROST PROTECTION OPERATING' indication has been provided on all associated heating plant graphics.

53 The boilers operate under their own sequencer control until the common primary return water temperature has risen to [60]°C. At this point provided that no other 'SECONDARY HEATING DEMAND' signal is present, the sequencers are disabled and the frost routine will repeat as necessary.

PLANT MONITORING AND CONTROL INTERLOCKS

Boiler Failure

54 When in the winter mode, a common alarm from a boiler module bank has no other effect than to raise an alarm at the BMS operator's station.

55 In the summer mode, if a common alarm, either 'lockout' or 'high limit' is present from the duty boiler bank and the common flow temperature is less than 70°C for 10 minutes, then that bank of boilers will be deemed to have failed, a failed flag set for that bank of modules in software, and the duty sequencer disabled.

56 After a [60] second delay, the isolating valve on the standby bank is driven open. Once this valve has been proved open by its open endswitch, the duty point is changed to make the standby bank the new duty bank and the failed bank's isolation valve driven closed.

57 Following a 120 second time delay, the sequencer for the new duty bank of boilers will be enabled provided all the interlocks stated in **Boiler Controls and Interlocks** are satisfied.

58 With one bank of boilers 'failed', no further action is taken if a 'lockout' or 'high limit' signal is received from the new duty boilers and the sequencer remains enabled all the time the boilers are required to run.

59 With a boiler bank 'failed' flag set, automatic duty rotation is inhibited until the flag is reset by an operator.

60 Should the mode of operation change from summer to winter with a boiler bank 'failed', the 'failed' bank is brought into the winter mode of operation as normal.

Primary Pump Failure

61 The pumps have been arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the pumps are off.

62 The pumps are monitored for individual running status', with a common differential pressure switch, piped across both pumps and wired in series with an auxiliary contact on the respective pump's starter.

63 Following a pump start command, the failure alarm for the pump, derived from a mismatch between the pump command and its running status, inhibited for a period of [20] seconds, allowing time for the pump to run up to speed.

64 In the event of a pump failure, as detected by a mismatch between the BMS command to the pump and the pump status, an alarm is raised on the BMS operator's station and the pump commanded off. A software flag for the failed pump is set.

65 If the duty pump fails, the standby pump will immediately start and the duty point changed to make that pump the duty pump. The automatic timed duty changeover inhibited until the failure flag for the failed pump has been reset by an operator.

66 If with one pump failed, the other pump of the pair fails, an additional alarm indicating both pumps failed will be raised, which will only clear when one or both pump failed flags for the pair have been reset. The boiler system will be put in the Shutdown State with both sequencers disabled and the PRIMARY PUMP RUNNING signal is removed.

Boiler Safety Circuit

67 The safety circuit consists of contacts from the panic buttons, gas detection circuit and the fire system interlock wired in series. All the safety circuit operations has been hardwire interlocked. All of the interlocks have their actions duplicated in software by the BMS in order to prevent unnecessary alarms.

68 Activation of the safety circuit will, through hardwiring, shut down the boilers, primary pumps and all secondary pumps and the solenoid gas valve will close.

69 The boiler safety circuit has been designed to be failsafe, such that upon loss of continuity in the circuit, the circuit operates. Once operated, the safety circuit only resets by use of the MCC fascia reset push-button, or one of the plant reset buttons located by the panic buttons (as described below), once all the circuit's components are in a healthy state.

70 A 'delay on energise' timer, with a setting of 2 seconds, has been wired in parallel with the reset buttons, and hs been configured to automatically reset the circuit upon the loss and subsequent resumption of power to the MCC, providing that all the safety circuit's components are in a healthy state.

Panic Buttons

71 The boiler room plant has been protected by 2 No. emergency stop buttons located adjacent to each plant room exit and they have been wired into the boiler safety circuit. Operation of a panic button raises a critical alarm at the BMS operator's station.

Gas Detection

72 A gas detection unit has been provided and is located within MCC B/1. The gas detection unit provides five sensors, two per bank of boiler modules and one located in the gas meter room. The set point of the gas detection unit will be 1% LEL. On detection of gas from any one of the gas sensing heads a critical alarm is raised on the BMS operator's station, and the safety circuit operated.

73 The gas detection unit is fail safe and is monitored for a 'fault' condition. In the event of a fault occurring in the gas detection unit or any of the gas sensor heads, the safety circuit will be operated. A 'GAS SENSOR FAULT' indication will be provided on MCC B/1 facia.

74 Gas detected alarms have been provided from each gas sensing head at the BMS operator's station, and a 'GAS DETECTED' indication provided on MCC B/1 facia on operation.

Gas Valve Interlocks

75 During normal system operation the main gas solenoid valve is maintained in its open position. The BMS monitors the gas valve for its open position via valve actuator end switches. A gas valve open indication has been provided on the MCC facia.

76 Closure of the main gas solenoid valve, in any condition raises a 'Gas Valve Closed' alarm on the BMS operator's station, shut down the boilers and provide indication of a closed valve condition on MCC B/1 facia.

77 The safety circuit/gas solenoid valve resets via the MCC fascia and panic button plant rest push-buttons provided that the safety circuit interlocks are healthy.

78 If for any reason the power supply to the main gas solenoid valve is interrupted, the gas valve closes and the boiler plant shuts down.

LTHW Circuit Pressurisation Unit

79 The pressurisation unit is a packaged unit complete with all necessary controls and pressure switches. Independent high and low pressure switches have also been provided.

80 The pressurisation unit power feed is maintained via a contactor, the coil of which is energised via the normally closed contacts of a BMS digital output. The contactor is continuously energised except where detailed below.

81 The BMS monitors the pressurisation for a common fault and both the pressurisation unit's pumps' running status. These signals are derived via volt free contacts located within the pressurisation unit's local control panel.

Fault Condition

82 In the event of a pressurisation unit fault condition an alarm is raised on the BMS operator's station.

Low Pressure Condition

83 In the event of a low-pressure condition a critical alarm is raised on the BMS operator's station, the boilers are disabled and the primary and secondary circuit pumps stopped through hardwiring. This interlock also applies to the 'Test' pole of each item of plant's 'Test/Off/Auto' selector switch.

84 The boiler plant will not re-enter the normal automatic control sequence until the low pressure condition has been cleared and the BMS operator acknowledges and clears the alarm event at the BMS operator's station.

High Pressure Condition

85 In the event of a high-pressure condition a critical alarm is raised on the BMS operator's station and the boilers disabled. The primary and secondary circuit pumps operating at the time of the high-pressure event continues to operate. This interlock is also hard wired.

86 The boilers only re-enter the automatic control sequence when the high-pressure condition has been cleared and the BMS operator acknowledges and clears the alarm event at the BMS operator's station.

Pressurisation Unit Pump Monitoring

87 In the event that one of the pressurisation unit pumps has been running continuously for more than a [10] minute period an alarm is raised on the BMS operator's station indication that a leak may be occurring and that investigation is required.

88 In the event that the pressurisation unit pumps have been running continuously for a 30 minute period a critical alarm is raised on the BMS operator's station and the pressurisation unit and the boiler plant shutdown. The pressurisation unit power feed will be reinstated when the BMS operator acknowledges and clears the alarm event.

89 Upon receipt by the BMS of healthy high and low pressure conditions the boiler plant will be re-started following a normal sequence re-start.

Monitoring

90 The BMS monitors the flow temperature of each of the boiler banks.

91 The BMS monitors the common primary flow and return water temperature.

Fire Interlock Control

92 The plant has been hardwire interlocked, via the safety circuit, with the building's automatic fire detection system as described under **FIRE CONTROL** (System 999).

Plant Re-start Sequence

93 The plant has been interlocked, through software, to sequentially restart following:

1. Fire alarm shutdown.
2. Power failure.
3. Safety circuit reset.

D.1.33 FCU Secondary LTHW Circuit - System 101

GENERAL

1 The FCU secondary heating circuit is a variable temperature, constant volume circuit and consists of a duty/standby constant speed pump set in a compensated circuit arrangement with an associated three-port mixing valve.

2 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

Motor Control Centre Details

3 Control equipment, and switchgear associated with this plant is housed in Motor Control Centre MCC B/1.

4 Selector switches and indicator lamps have been incorporated on the fascia of Motor Control Centre MCC B/1 as follows.

MOTOR CONTROL CENTRE MCC B/1		
TITLE	SWITCH POSITIONS	INDICATION
FCU SECONDARY LTHW CIRCUIT PUMP No.1 101/SPC/001	TEST/OFF/AUTO	RUNNING/TRIPPED
FCU SECONDARY LTHW CIRCUIT PUMP No.2 101/SPC/002	TEST/OFF/AUTO	RUNNING/TRIPPED

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the pumps to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a pump failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in there 'auto' positions the following controls strategy apply.

System Start

8 The FCU secondary LTHW circuit is started and stopped via a HEATING DEMAND signal from the fan coil unit systems served by this circuit (systems 30 to 41).

9 Upon receipt of a HEATING DEMAND signal from at least one of the FCU systems, a SECONDARY HEATING DEMAND signal is sent to the primary heating system. Upon confirmation of a duty primary pump running status from system 100, the FCU secondary LTHW circuit duty pump will start and the temperature control loop enabled.

Temperature Control

10 The mixed flow temperature sensor, located after the pump set, will modulate, via a proportional plus integral control loop, the three-port mixing valve in order to maintain the flow temperature at its setpoint ±1K.

11 The mixed flow setpoint will be proportionately scheduled against the outside air temperature such that at 0.0°C outside, the mixed flow setpoint will be 60.0°C, falling to 40.0°C at 18.0°C outside. The setpoint will not be set outside the given limits.

Plant Shutdown

12 The FCU secondary LTHW circuit is disabled from operating when there are no HEATING DEMAND signals present from any of the FCU systems. In this event, the duty pump be stops and the SECONDARY HEATING DEMAND signal will be removed from the primary heating system. The three-port mixing valve will be driven to the full flow to bypass position.

PLANT MONITORING AND GENERAL CONTROL INTERLOCKS

Primary Circuit Failure Software Interlocks

13 In the event that both boiler primary circuit circulating pumps fail, the FCU secondary LTHW circuit will be shutdown as described in the system 100 narrative description of operation.

Hardwire Interlocks

14 In the event of a packaged pressurisation unit low-pressure condition, the FCU secondary LTHW circuit pumps will be shutdown. This interlock is additionally hardwired. Refer to system 100 narrative description of operation **LTHW Circuit Pressurisation Unit** for interlocking details.

15 In the event of the boiler safety circuit operating, the FCU secondary LTHW circuit pumps shutdown. This interlock additionally be hardwired. Refer to the system 100 narrative description of operation **Boiler Safety Circuit** for interlocking details.

16 The hardwired interlocks to the pumps operate whether the selector switches are in the 'test' or 'auto' positions. The system software duplicates the hardwired interlocks to prevent unnecessary alarms.

Pump Failure and Rotation

17 The pumps are arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the pumps are off.

18 The pumps are monitored for individual running status', with a common differential pressure switch piped across both pumps and wired in series with an auxiliary contact on the respective pump's starter.

19 Following a pump start command, the failure alarm for the pump, derived from a mismatch between the pump command and its running status, is inhibited for a period of [20] seconds, allowing time for the pump to run up to speed.

20 In the event of a pump failure, as detected by a mismatch between the BMS command to the pump and the pump status, an alarm is raised on the BMS operator's station and the pump commanded off. A software flag for the failed pump will be set.

21 If the duty pump fails, the standby pump immediately starts and the duty point changed to make that pump the duty pump. The automatic timed duty changeover will be inhibited until the failure flag for the failed pump has been reset by an operator.

If with one pump failed, the other pump of the pair fails, an additional alarm indicating both pumps failed is raised, which only clears when one or both pump failed flags for the pair have been reset.

Plant Re-start Sequence

22 The plant has been interlocked, through software, to sequentially restart following:

1. Fire alarm shutdown.
2. Safety Circuit Shutdown.
4. Pressurisation Unit Shutdown.

D.1.34 AHU Secondary LTHW Circuit - System 102

GENERAL

1 The AHU secondary heating circuit is a constant temperature, constant volume circuit and consists of a duty/standby constant speed pump set serving the AHU heater batteries.

2 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

Motor Control Centre Details

3 Control equipment, and switchgear associated with this plant is housed in Motor Control Centre MCC B/1.

4 Selector switches and indicator lamps have been incorporated on the fascia of Motor Control Centre MCC B/1 as follows.

MOTOR CONTROL CENTRE MCC B/1		
TITLE	SWITCH POSITIONS	INDICATION
AHU SECONDARY LTHW CIRCUIT PUMP No.1 102/SPC/001	TEST/OFF/AUTO	RUNNING/TRIPPED
AHU SECONDARY LTHW CIRCUIT PUMP No.2 102/SPC/002	TEST/OFF/AUTO	RUNNING/TRIPPED

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the pumps to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a pump failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in their 'auto' positions the following controls strategy will apply.

System Start

8 The AHU secondary LTHW circuit start and stop via a HEATING DEMAND signal from the AHUs served by this circuit.

9 Upon receipt of a HEATING DEMAND signal from one of the AHUs, a SECONDARY HEATING DEMAND signal is sent to the primary heating system. Upon confirmation of a duty primary pump running status from system 100, the AHU secondary LTHW circuit duty pump will be started.

AHU Heat Available Signal

10 An AHU HEAT AVAILABLE signal is sent to the AHUs served by this circuit (systems 1,2, & 3) provided a primary pump running status is present, an AHU secondary pump running status is present and the common boiler flow temperature is 10°C or greater.

11 Should any of the above conditions be lost, the AHU HEAT AVAILABLE signal will be removed.

Plant Shutdown

12 The AHU secondary LTHW circuit is disabled from operating when there are no HEATING DEMAND signals present from any of the AHUs. In this event, the duty pump stops and the SECONDARY HEATING DEMAND signal removed from the primary heating system.

PLANT MONITORING AND GENERAL CONTROL INTERLOCKS

Primary Circuit Failure Software Interlocks

13 In the event that both boiler primary circuit circulating pumps fail, the AHU secondary LTHW circuit is shutdown as described in the system 100 narrative description of operation.

Hardwire Interlocks

14 In the event of a packaged pressurisation unit low-pressure condition, the AHU secondary LTHW circuit pumps shutdown. This interlock has additionally been hardwired. Refer to system 100 narrative description of operation **LTHW Circuit Pressurisation Unit** for interlocking details.

15 In the event of the boiler safety circuit operating, the AHU secondary LTHW circuit pumps will shutdown. This interlock has additionally been hardwired. Refer to the system 100 narrative description of operation **Boiler Safety Circuit** for interlocking details.

16 The hardwired interlocks to the pumps operates whether the selector switches are in the 'test' or 'auto' positions. The system software duplicates the hardwired interlocks to prevent unnecessary alarms.

Frost

17 Refer to the Primary Boiler Plant narrative, system 100, for interlocking details.

Pump Failure and Rotation

18 The pumps have been arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the pumps are off.

19 The pumps are monitored for individual running status', with a common differential pressure switch, piped across both pumps and wired in series with an auxiliary contact on the respective pump's starter.

20 Following a pump start command, the failure alarm for the pump, derived from a mismatch between the pump command and its running status, is inhibited for a period of 20 seconds, allowing time for the pump to run up to speed.

21 In the event of a pump failure, as detected by a mismatch between the BMS command to the pump and the pump status, an alarm is raised on the BMS operator's station and the pump commanded off. A software flag for the failed pump will be set.

22 If the duty pump fails, the standby pump will immediately start and the duty point changed to make that pump the duty pump. The automatic timed duty changeover inhibited until the failure flag for the failed pump has been reset by an operator.

23 If with one pump failed, the other pump of the pair fails, an additional alarm indicating both pumps failed is raised, which only clear when one or both pump failed flags for the pair have been reset.

Plant Re-start Sequence

24 The plant has been interlocked, through software, to sequentially restart following:

1. Fire alarm shutdown.
2. Safety Circuit Shutdown.
3. Pressurisation Unit Shutdown.

D.1.35 **DHWS Calorifier LTHW Circuit - System 103**

GENERAL

1 The DHWS calorifier LTHW circuit is a constant temperature, constant volume circuit and consists of a duty/standby constant speed twin-head pump set serving two storage calorifiers. There is no secondary side pumping.

2 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

Motor Control Centre Details

3 Control equipment, and switchgear associated with this plant is housed in Motor Control Centre MCC B/1.

4 Selector switches and indicator lamps have been incorporated on the fascia of Motor Control Centre MCC B/1 as follows.

MOTOR CONTROL CENTRE MCC B/1		
TITLE	SWITCH POSITIONS	INDICATION
DHWS CALORIFIER LTHW CIRCUIT PUMP No.1 103/SPC/001	TEST/OFF/AUTO	RUNNING/TRIPPED
DHWS CALORIFIER LTHW CIRCUIT PUMP No.2 103/SPC/002	TEST/OFF/AUTO	RUNNING/TRIPPED
DHWS CALORIFIER No.1	-	HIGH LIMIT
DHWS CALORIFIER No.2	-	HIGH LIMIT

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the pumps to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configure itself as for a pump failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in their 'auto' positions the following controls strategy will apply.

System Start

8 The DHWS calorifier LTHW circuit will start and stop via its own time schedule.

9 At the beginning of the time schedule period, a SECONDARY HEATING DEMAND signal is sent to the primary heating system. Upon confirmation of a duty primary pump running status from system 100, the duty DHWS calorifier LTHW circuit pump will start and the calorifier temperature control loops enabled.

Calorifier Temperature Control

10 For each calorifier, a temperature sensor located in the calorifier controls the associated three-port control valve to maintain the calorifier at its setpoint.

11 The valve actuators are the spring return type, such that upon loss of power to an actuator, it drives the valve to the full flow to bypass position.

12 When the sensed calorifier temperature drops below 60.0°C, the three-port control valve is driven to the full flow to the calorifier position.

13 When the sensed calorifier temperature rises above 62.0°C, the three-port control valve is driven to the full flow to bypass position.

Calorifier High Limit

14 Each calorifier has a hand-reset thermostat, set to trip at 70°C, located in the top of the calorifier.

15 Upon the thermostat tripping, the power feed to the associated three-port control valve is broken, causing the valve to spring to the full bypass position, and an alarm to be raised at the BMS operator's station. The BMS also drives the valve to the full bypass position in software if it is not already being driven.

16 Upon the manual resetting of the thermostat, normal temperature control for the calorifier will be resumed.

Plant Shutdown

17 At the end of the time schedule period, the DHWS calorifier LTHW circuit is disabled from operating and the SECONDARY HEATING DEMAND signal removed from the primary heating system. The duty DHWS calorifier LTHW circuit pump stops and the calorifier temperature control loops disabled. The three-port control valves will be driven to their full flow to bypass positions.

PLANT MONITORING AND GENERAL CONTROL INTERLOCKS

Temperature Alarms

18 During a time schedule period, an alarm is raised at the BMS operator's terminal for a calorifier if the sensed temperature falls below 18°C for longer than 30 minutes. This alarm will be disabled out of time schedule periods and during a high limit shutdown.

Primary Circuit Failure Software Interlocks

19 In the event that both boiler primary circuit circulating pumps fail, the DHWS calorifier LTHW circuit will shutdown as described in the

system 100 narrative description of operation.

Hardwire Interlocks

20 In the event of a packaged pressurisation unit low pressure condition, the DHWS calorifier LTHW circuit pumps will shutdown. This interlock has additionally been hardwired. Refer to system 100 narrative description of operation **LTHW Circuit Pressurisation Unit** for interlocking details.

21 In the event of the boiler safety circuit operating, the DHWS calorifier LTHW circuit pumps will shutdown. This interlock has additionally been hardwired. Refer to the system 100 narrative description of operation **Boiler Safety Circuit** for interlocking details.

22 The hardwired interlocks to the pumps operate whether the selector switches are in the 'test' or 'auto' positions. The system software duplicates the hardwired interlocks to prevent unnecessary alarms.

Pump Failure and Rotation

23 The DHWS calorifier LTHW pumps have been arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the pumps are off.

24 The pumps ar monitored for individual running status', via an auxiliary contact on the respective pump's starter.

25 Following a pump start command, the failure alarm for the pump, derived from a mismatch between the pump command and its running status, is inhibited for a period of 20 seconds, allowing time for the pump to run up to speed.

26 In the event of a pump failure, as detected by a mismatch between the BMS command to the pump and the pump status, an alarm is raised on the BMS operator's station and the pump commanded off. A software flag for the failed pump has been set.

27 If the duty pump fails, the standby pump immediately starts and the duty point changed to make that pump the duty pump. The automatic timed duty changeover is inhibited until the failure flag for the failed pump has been reset by an operator.

28 If with one pump failed, the other pump of the pair fails, an additional

alarm indicating both pumps failed is raised, which will only clear when one or both pump failed flags for the pair have been reset.

29 Should both DHWS calorifier LTHW pumps fail, the system will be put in its shutdown state.

Plant Re-start Sequence

30 The plant is interlocked, through software, to sequentially restart following:

1. Fire alarm shutdown.
2. Safety Circuit Shutdown.
5. Pressurisation Unit Shutdown.

D.1.36 Radiator & Landlord's LTHW Circuit - System 104

GENERAL

1 The radiator and landlord's LTHW circuit is a variable temperature, constant volume circuit and consists of a duty/standby constant speed twin-head pump set in a compensated circuit arrangement with an associated three-port mixing valve. The circuit serves radiators fitted with TRVs, and the basement AHU heater batteries serving the landlord's areas. Because the variable volume part of the circuit, the radiators, is small compared to the constant volume heater batteries, there is no pressure control or flow bypass valve required.

2 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

Motor Control Centre Details

3 Control equipment, and switchgear associated with this plant is housed in Motor Control Centre MCC B/1.

4 Selector switches and indicator lamps has been incorporated on the fascia of Motor Control Centre MCC B/1 as follows.

MOTOR CONTROL CENTRE MCC B/1		
TITLE	SWITCH POSITIONS	INDICATION
RADIATOR & LANDLORD'S LTHW CIRCUIT PUMP No.1 104/SPC/001	TEST/OFF/AUTO	RUNNING/TRIPPED
RADIATOR & LANDLORD'S LTHW CIRCUIT PUMP No.2 104/SPC/002	TEST/OFF/AUTO	RUNNING/TRIPPED

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and allows the pumps to run

out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a pump failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in their 'auto' positions the following controls strategy will apply.

System Start

8 The radiator LTHW circuit will start and stop under the dictates of its own time schedule or else upon receipt of a HEATING DEMAND signal from the associated systems.

9 When the plant is required to run, a SECONDARY HEATING DEMAND signal is sent to the primary heating system. Upon confirmation of a duty primary pump running status from system 100, the radiator LTHW circuit duty pump will be started and the temperature control loop enabled.

Temperature Control

10 The mixed flow temperature sensor, located after the pump set, will modulate, via a proportional plus integral control loop, the three-port mixing valve in order to maintain the flow temperature at its setpoint ±1K.

11 The mixed flow setpoint is proportionately scheduled against the outside air temperature such that at 0.0°C outside, the mixed flow setpoint will be 80.0°C, falling to 40.0°C at 20.0°C outside. The setpoint will not be set outside the given limits.

Temperature Hold-Off

12 Should the outside air temperature exceed [18] C, the radiator LTHW circuit is inhibited from operating, the duty pump stopped and the

SECONDARY HEATING DEMAND signal removed. Once the outside air temperature falls below [17] C, the system will be allowed to operate again as normal.

Plant Shutdown

13 When the plant is required to shutdown, the duty pump stops and the SECONDARY HEATING DEMAND signal removed from the primary heating system. The three-port mixing valve is driven to the full flow to bypass position.

Primary Circuit Failure Software Interlocks

14 In the event that both boiler primary circuit circulating pumps fail, the radiator LTHW circuit will shutdown as described in the system 100 narrative description of operation.

Hardwire Interlocks

15 In the event of a packaged pressurisation unit low-pressure condition, the radiator LTHW circuit pumps will shutdown. This interlock has additionally be hardwired. Refer to system 100 narrative description of operation **LTHW Circuit Pressurisation Unit** for interlocking details.

16 In the event of the boiler safety circuit operating, the radiator LTHW circuit pumps will shutdown. This interlock has additionally be hardwired. Refer to the system 100 narrative description of operation **Boiler Safety Circuit** for interlocking details.

17 The hardwired interlocks to the pumps operate whether the selector switches are in the 'test' or 'auto' positions. The system software duplicates the hardwired interlocks to prevent unnecessary alarms.

Pump Failure and Rotation

18 The pumps have been arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the pumps are off.

19 The pumps are monitored for individual running status via an auxiliary contact on the respective pump's starter.

20 Following a pump start command, the failure alarm for the pump, derived from a mismatch between the pump command and its running

status, is inhibited for a period of 20 seconds, allowing time for the pump to run up to speed.

21 In the event of a pump failure, as detected by a mismatch between the BMS command to the pump and the pump status, an alarm is raised on the BMS operator's station and the pump commanded off. A software flag for the failed pump will be set.

22 If the duty pump fails, the standby pump immediately starts and the duty point will be changed to make that pump the duty pump. The automatic timed duty changeover is inhibited until the failure flag for the failed pump has been reset by an operator. If with one pump failed, the other pump of the pair fails, an additional alarm indicating both pumps failed is raised, which will only clear when one or both pump failed flags for the pair have been reset.

Plant Re-start Sequence

23 The plant is interlocked, through software, to sequentially restart following:

1. Fire alarm shutdown.
2. Safety Circuit Shutdown.
3. Pressurisation Unit Shutdown.

D.1.37 Primary Chilled Water Plant - System 200

GENERAL

1 The chilled water plant consists of two equal sized water cooled chillers, a duty/standby primary circuit circulating pump set, a duty/standby condenser circuit circulating pump set, three dry air coolers and two packaged pressurisation units, one for the chilled water circuit and one for the condenser water circuit. The condenser water circuit contains glycol.

2 The secondary cooling system consists of two constant volume circuits. One circuit serves the FCUs, and one serves the AHUs. Refer to the system 201 and 202 narratives for details.

3 The chillers and the dry air coolers are controlled by the chiller manufacturer's own sequencer package which is enabled to run via a command from the BMS.

4 Refer to the mechanical services drawings for equipment locations and the CHW schematics.

Motor Control Centre Details

5 Control equipment and switchgear associated with the chilled water plant is housed in Motor Control Centre MCC B/1 and MCC7/1.

6 Selector switches and indicator lamps have been incorporated on the facia of the Motor Control Centres as follows.

MOTOR CONTROL CENTRE MCC B/1		
TITLE	SWITCH POSITION	INDICATION
CHILLER SEQUENCER 200/CHO/001	OFF/AUTO	ENABLED/FAULT
PRIMARY CHILLED WATER PUMP NO.1 200/PPC/001	TEST/OFF/AUTO	RUNNING/TRIPPED

MOTOR CONTROL CENTRE MCC B/1		
TITLE	SWITCH POSITION	INDICATION
PRIMARY CHILLED WATER PUMP NO.2 200/PPC/002	TEST/OFF/AUTO	RUNNING/TRIPPED
PRIMARY CONDENSER WATER PUMP NO.1 200/PPC/003	TEST/OFF/AUTO	RUNNING/TRIPPED
PRIMARY CONDENSER WATER PUMP NO.2 200/PPC/004	TEST/OFF/AUTO	RUNNING/TRIPPED
PRIMARY CHILLED WATER PRESSURISATION UNIT 200/PRU/001	-	POWER ON/FAULT
PRIMARY CONDENSER WATER PRESSURISATION UNIT 200/PRU/002	-	POWER ON/FAULT
REFRIGERANT GAS DETECTOR	-	LOW LEVEL ALARM/HIGH LEVEL ALARM/ DETECTION UNIT FAULT
CHILLER ROOM SAFETY CIRCUIT	SAFETY CIRCUIT RESET (PUSHBUTTON)	CHILLER ROOM SAFETY CIRCUIT ACTIVATED

TEST

7 The `Test' position on the selector switches is provided for commissioning and maintenance purposes and allows the drives to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

8 When the plant is selected 'off' on the selector switches the plant stops. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant configures itself as for a failure as described under PLANT MONITORING AND CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

9 When the switches are selected to the 'auto' position the following controls strategy will apply.

Chiller Controls and Interlocks

10 The chillers are selected for a chilled water (CHW) flow temperature of 6°C and a return water temperature of 12°C.

11 The chillers are equally sized and the chillers and the three dry air coolers are controlled by the chiller manufacturer's own sequencer package.

12 When the chillers are required to operate, the chiller sequencer will only be enabled when all of the following hardwired interlocks are satisfied.

(i) The duty chilled water primary pump is running as detected by an auxiliary contact on the pump's motor starter and a differential pressure switch measuring across the pump.

(ii) The duty condenser water primary pump is running as detected by an auxiliary contact on the pump's motor starter and a differential pressure switch measuring across the pump.

(iii) The safety circuit is healthy (panic buttons, fire condition etc).

(iv) The system pressure is not out-of-limits.

13 Note: Each chillers' own packaged controls prevents that chiller from operating if no flow is sensed through the chiller due to local isolation.

Plant Start

14 The primary chilled water plant will start and stop under the dictates of SECONDARY COOLING DEMAND signals from system 201 & 202.

15 On receipt of at least one SECONDARY COOLING DEMAND signal from system 201 & 202, the primary chilled water circuit will start as described below.

16 On receipt of a demand signal from one of the above the duty chilled water primary pump will start. 11 seconds later the duty condenser water primary pump will start. Once all its interlocks have been satisfied, the chiller sequencer will be enabled and the condenser water temperature control loop enabled .

17 Upon receipt of a primary pump running status, a 'PRIMARY PUMP CONFIRMED' signal is sent to any secondary circuit outstation with a current cooling demand, to enable the duty secondary pump(s) to be started.

Condenser Water Temperature Control

18 Two three-port mixing valves have been installed in the return condenser pipework from the dry air coolers.

19 Upon initial startup of the chillers, the valves are held in the full bypass position until the condenser return temperature sensor detects a temperature above 20°C, at which time the valves will be put under the control of a proportional plus integral control loop and the valves will be modulated in sequence to maintain a minimum condenser return temperature of 18°C.

Chiller Plant Shutdown and Run-On

20 Upon loss of both SECONDARY COOLING DEMAND signals, the chiller sequencer will be disabled and the PRIMARY PUMP RUNNING signal removed. After a further period of 10 minutes, the duty primary condenser water pump and the duty primary chilled water pump will stop.

21 The two condenser water control valves are held in the full bypass position whilst the chiller plant is shut down.

PLANT MONITORING AND CONTROL INTERLOCKS

Primary Chilled Water Pump Control and Failure

22 The pumps have been arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the pumps are off.

23 The pumps are monitored for individual running status', with a common differential pressure switch, piped across both pumps and wired in series with an auxiliary contact on the respective pump's starter.

24 Following a pump start command, the failure alarm for the pump, derived from a mismatch between the pump command and its running status, will be inhibited for a period of 20 seconds, allowing time for the pump to run up to speed.

25 In the event of a pump failure, as detected by a mismatch between the BMS command to the pump and the pump status, an alarm is raised on the BMS operator's station and the pump commanded off. A software flag for the failed pump is set.

26 If the duty pump fails, the standby pump will immediately start and the duty point will change to make that pump the duty pump. The automatic timed duty changeover will be inhibited until the failure flag for the failed pump has been reset by an operator.

27 If with one pump failed, the other pump of the pair fails, an additional alarm indicating both pumps failed is raised, which will only clear when one or both pump failed flags for the pair have been reset. The chiller sequencer is disabled and the PRIMARY PUMP RUNNING signal be removed. After a 10-minute period, the duty primary condenser water pump will be stopped.

Primary Condenser Water Pump Control and Failure

28 The pumps have been arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the pumps are off.

29 The pumps are monitored for individual running status', with a common differential pressure switch, piped across both pumps and wired in series with an auxiliary contact on the respective pump's starter.

30 Following a pump start command, the failure alarm for the pump, derived from a mismatch between the pump command and its running status, is inhibited for a period of 20 seconds, allowing time for the pump to run up to speed.

31 In the event of a pump failure, as detected by a mismatch between the BMS command to the pump and the pump status, an alarm is raised on the BMS operator's station and the pump commanded off. A software flag for the failed pump is be set.

32 If the duty pump fails, the standby pump will immediately start and the duty point is changed to make that pump the duty pump. The automatic timed duty changeover is inhibited until the failure flag for the failed pump has been reset by an operator.

33 If with one pump failed, the other pump of the pair fails, an additional alarm indicating both pumps failed is raised, which will only clear when one or both pump failed flags for the pair have been reset. The chiller sequencer is disabled. After a 10 minute period, the duty primary chilled water pump will stopp and the PRIMARY PUMP RUNNING signal will be removed.

Chiller Safety Circuit

34 The chiller safety circuit consists of contacts from the panic buttons, refrigerant gas detection circuit and the fire system interlock wired in series. All the safety circuit operations are hardwire interlocked. All of the interlocks have their actions duplicated in software by the BMS in order to prevent unnecessary alarms.

35 Activation of the safety circuit, through hardwiring, disables the chiller sequencer, all primary pumps and all secondary pumps.

36 The chiller safety circuit has been designed to be failsafe, such that upon loss of continuity in the circuit, the circuit operates. Once operated, the safety circuit will only reset by use of the MCC fascia reset push-button, or one of the plant reset buttons located by the panic

buttons (as described below), once all the circuit's components are in a healthy state.

37 A `delay on energise' timer, with a setting of 2 seconds, has been wired in parallel with the reset buttons, and have been configured to automatically reset the circuit upon the loss and subsequent resumption of power to the MCC, providing that all the safety circuit's components are in ahealthly state.

Panic Buttons

38 The chiller room plant is protected by 2 No. latch-in emergency stop buttons located adjacent to each chiller plantroom exit. In the event that one, or more of the panic buttons is operated, a critical alarm is raised on the BMS operator's station, the chiller sequencer disabled and all primary and secondary circuit pumps stopped.

Refrigerant Gas Detection

39 A refrigerant gas detection unit has been supplied, complete with sufficient channels and sensing tubes for all likely leak areas on the two chillers. The detector is located externally to MCC B/1. The detector has been configured for the detection of R410a.

40 The unit has been configured to generate two alarms per chiller. The first alarm has been set to 10ppm and will raise an alarm at the BMS operator's station and a 'LOW LEVEL ALARM' indication on the MCC fascia. The second alarm has been set at 800ppm and has been hardwired into the safety circuit to shut the chillers down and to raise a critical alarm at the BMS operator's station and a 'HIGH LEVEL ALARM' indication on the MCC fascia.

41 The gas detection unit is fail safe and is monitored for a 'fault' condition. In the event of a fault occurring in the gas detection unit, a 'REFRIGERANT GAS DETECTOR FAULT' indication will be provided on MCC B/1 facia and a critical alarm will be raised at the BMS operator's station.

CHW Circuit Pressurisation Unit

42 The pressurisation unit is a packaged unit complete with all necessary controls and pressure switches.

43 The pressurisation unit power feed is maintained via a contactor the coil of which is energised via the normally closed terminals of a BMS digital output. The contactor is continuously energised except where

detailed below.

44 The BMS monitors the pressurisation unit for a common fault and both pressurisation unit pump's running status. These signals are derived via volt-free contacts located within the pressurisation unit control panel.

45 Separate high and low pressure switches are provided for alarm indication purposes.

46 In the event of a pressurisation unit fault condition an alarm is raised on the BMS operator's station.

47 In the event of a low pressure condition a critical alarm is raised on the BMS operator's station, a low chilled water pressure flag set in software, the chiller sequencer is disabled and the primary and secondary chilled water pumps are stopped through hardwiring. This interlock also applies to the `Test' pole of each item of plants `Test/Off/Auto' switch.

48 The duty primary condenser pump continues to run-on for a period of [1] minutes, after which it will be stopped through software.

49 The chiller plant will not re-enter the automatic control sequence until the low pressure condition has been cleared, and the BMS operator resets the low pressure flag at the BMS operator's station.

50 In the event of a high pressure condition, a critical alarm is raised on the BMS operator's station.

51 In the event that one of the pressurisation unit pumps has been running continuously for more than a 10 minute period an alarm is raised on the BMS operator's station indicating that a leak may be occurring and investigation is required.

52 In the event that the pressurisation unit pumps have been running continuously for a 30 minute period a critical alarm is raised on the BMS operator's stations and the pressurisation unit power feed de-energised, a chilled water leak flag set in software and the chiller plant shuts down. The pressurisation unit feed will be reinstated upon operator reset of the chilled water leak flag.

53 Once all failure flags have been cleared and upon receipt by the BMS of healthy high and low pressure conditions the plant will be re-started using the normal re-start sequence.

Condenser Circuit Pressurisation Unit

54 The pressurisation unit is a packaged unit complete with all necessary controls and pressure switches.

55 The pressurisation unit power feed is maintained via a contactor the coil of which is energised via the normally closed terminals of a BMS digital output. The contactor is continuously energised except where detailed below.

56 The BMS monitors the pressurisation unit for a common fault and both pressurisation unit pump's running status. These signals are derived via volt-free contacts located within the pressurisation unit control panel.

57 Separate high and low pressure switches are provided for alarm indication purposes.

58 In the event of a pressurisation unit fault condition an alarm is raised on the BMS operator's station.

59 In the event of a low pressure condition a critical alarm is raised on the BMS operator's station, a low condenser water pressure flag set in software, the chiller sequencer is disabled and the primary condenser water pumps stopped through hardwiring. This interlock also applies to the `Test' pole of each item of plants `Test/Off/Auto' switch.

60 The duty chilled water and any secondary circuit pumps continue to run-on for a period of 1 minute, after which they will be stopped through software.

61 The chiller plant will not re-enter the automatic control sequence until the low pressure condition has been cleared, and the BMS operator resets the low pressure flag at the BMS operator's station.

62 In the event of a high pressure condition, a critical alarm is raised on the BMS operator's station.

63 In the event that one of the pressurisation unit pumps has been running continuously for more than a 10 minute period an alarm is raised on the BMS operator's station indicating that a leak may be occurring and investigation is required.

64 In the event that the pressurisation unit pumps have been running continuously for a [30] minute period a critical alarm is raised on the BMS operator's stations and the pressurisation unit power feed de-energised, a condenser water leak flag set in software and the chiller plant will shut down. The pressurisation unit feed will be reinstated upon operator reset of the condenser water leak flag.

65 Once all failure flags have been cleared and upon receipt by the BMS of healthy high and low pressure conditions the plant is re-started using the normal re-start sequence.

Temperature Monitoring

66 The BMS monitors each chiller's individual flow temperature and also monitors the common flow and return temperatures of the primary chilled water circuit and the common flow and return temperatures of the condenser water circuit.

67 A temperature detector located in the common chilled water flow pipework is connected to the BMS for temperature monitoring and provides 'OUT OF LIMITS' alarms when the measured temperature is 1 K above or below the set point of the chillers. These alarms are inhibited for 11 minutes on initial start up of the primary chilled water plant.

Chiller Monitoring

68 Each chiller is monitored for a common fault condition via volt-free contacts in its own control panel (not the sequencer), which brings up an appropriate alarm at the BMS operator's terminal upon its occurence.

Dry Air Cooler Monitoring

69 Each dry air cooler is monitored for a common fault condition via volt-free contacts in its own control panel (not the sequencer), which brings up an appropriate alarm at the BMS operator's terminal upon its occurence.

Fire Interlock Control

70 The chilled water plant is interlocked with the building's automatic fire detection as described under **FIRE CONTROL** (system 999).

Plant Restart Sequence

71 The plant is interlocked, through software, to sequentially restart following:-

1. Fire alarm shutdown.
2. Power failure.
3. Pressurisation unit shutdown.

D.1.38 **FCU Secondary CHW Circuit - System 201**

GENERAL

1 The FCU secondary chilled water circuit is a constant temperature, constant volume circuit and consists of a duty/standby constant speed pump set serving the FCU cooler batteries.

2 Refer to the mechanical services drawings for equipment locations and the boiler circuit schematic.

Motor Control Centre Details

3 Control equipment, and switchgear associated with this plant is housed in Motor Control Centre MCC B/1.

4 Selector switches and indicator lamps are incorporated on the fascia of Motor Control Centre MCC B/1 as follows.

MOTOR CONTROL CENTRE MCC B/1		
TITLE	SWITCH POSITIONS	INDICATION
FCU SECONDARY CHW CIRCUIT PUMP No.1 201/SPC/001	TEST/OFF/AUTO	RUNNING/TRIPPED
FCU SECONDARY CHW CIRCUIT PUMP No.2 201/SPC/002	TEST/OFF/AUTO	RUNNING/TRIPPED

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and will allow the pumps to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant will stop. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant will configure itself as for a pump failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in their 'auto' positions the following controls strategy will apply.

System Start

8 The FCU secondary CHW circuit is started and stopped via a COOLING DEMAND signal from the FCUs served by this circuit (systems 30 to 41).

9 Upon receipt of a COOLING DEMAND signal from at least one of the FCU systems, a SECONDARY COOLING DEMAND signal is sent to the primary cooling system. Upon receipt of a PRIMARY PUMP CONFIRMED signal from system 200, the FCU secondary CHW circuit duty pump will be started.

Plant Shutdown

10 The FCU secondary CHW circuit is disabled from operating when there are no COOLING DEMAND signals present from any of the FCU systems. In this event, the duty pump will be stopped and the SECONDARY COOLING DEMAND signal will be removed from the primary cooling system.

PLANT MONITORING AND GENERAL CONTROL INTERLOCKS

Primary Circuit Failure Software Interlocks

11 In the event that both chilled water primary circuit or condenser water circuit circulating pumps fail, the FCU secondary CHW circuit are shutdown as described in the system 200 narrative description of operation.

Hardwire Interlocks

12 In the event of a packaged chilled water pressurisation unit low pressure condition, the FCU secondary CHW circuit pumps are shutdown. This interlock has additionally been hardwired. Refer to system 200 narrative description of operation **CHW Circuit Pressurisation Unit** for interlocking details.

13 In the event of the chiller safety circuit operating, the FCU secondary CHW circuit pumps are shutdown. This interlock has additionally been hardwired. Refer to the system 200 narrative description of operation **Chiller Safety Circuit** for interlocking details.

14 The hardwired interlocks to the pumps will operate whether the selector switches are in the 'test' or 'auto' positions. The system software will duplicate the hardwired interlocks to prevent unnecessary alarms.

Pump Failure and Rotation

15 The pumps are arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the pumps are off.

16 The pumps are monitored for individual running status', with a common differential pressure switch, piped across both pumps and wired in series with an auxiliary contact on the respective pump's starter.

17 Following a pump start command, the failure alarm for the pump, derived from a mismatch between the pump command and its running status, will be inhibited for a period of 20 seconds, allowing time for the pump to run up to speed.

18 In the event of a pump failure, as detected by a mismatch between the BMS command to the pump and the pump status, an alarm is raised on the BMS operator's station and the pump commanded off. A software flag for the failed pump will be set.

19 If the duty pump fails, the standby pump will be immediately started and the duty point will be changed to make that pump the duty pump. The automatic timed duty changeover is inhibited until the failure flag for the failed pump has been reset by an operator.

20 If with one pump failed, the other pump of the pair fails, an additional alarm indicating both pumps failed is raised, which will only clear when one or both pump failed flags for the pair have been reset. The SECONDARY COOLING DEMAND signal is removed from the primary cooling system.

Plant Re-start Sequence

21 The plant is interlocked, through software, to sequentially restart following:

1. Fire alarm shutdown.
2. Safety Circuit Shutdown.
4. Pressurisation Unit Shutdown.

D.1.39 AHU Secondary CHW Circuit - System 202

GENERAL

1 The AHU secondary cooling circuit is a constant temperature, constant volume circuit and consists of a duty/standby constant speed pump set serving the AHU cooler batteries.

2 Refer to the mechanical services drawings for equipment locations and the chiller circuit schematic.

Motor Control Centre Details

3 Control equipment, and switchgear associated with this plant is housed in Motor Control Centre MCC B/1.

4 Selector switches and indicator lamps are incorporated on the fascia of Motor Control Centre MCC B/1 as follows.

MOTOR CONTROL CENTRE MCC B/1		
TITLE	SWITCH POSITIONS	INDICATION
AHU SECONDARY CHW CIRCUIT PUMP No.1 202/SPC/001	TEST/OFF/AUTO	RUNNING/TRIPPED
AHU SECONDARY CHW CIRCUIT PUMP No.2 202/SPC/002	TEST/OFF/AUTO	RUNNING/TRIPPED

TEST

5 The 'test' position on the selector switches is provided for commissioning and maintenance purposes and will allow the pumps to run out of normal automatic control provided all safety interlocks are satisfied.

OFF

6 When the plant is selected 'off' on the selector switches the plant will stop. If the 'off' position is selected whilst the plant is running under automatic control, the rest of the plant will configure itself as for a pump failure as described under PLANT MONITORING AND GENERAL CONTROL INTERLOCKS, and the alarms raised will have to be cleared before the plant will run again under automatic control.

AUTO

7 When all of the switches are in their 'auto' positions the following controls strategy will apply.

System Start

8 The AHU secondary CHW circuit is started and stopped via a COOLING DEMAND signal from the AHUs served by this circuit.

9 Upon receipt of a COOLING DEMAND signal from one of the AHUs, a SECONDARY COOLING DEMAND signal is sent to the primary cooling system. Upon receipt of a PRIMARY PUMP CONFIRMED signal from system 200, the AHU secondary CHW circuit duty pump will be started.

Plant Shutdown

10 The AHU secondary CHW circuit is disabled from operating when there are no COOLING DEMAND signals present from any of the AHUs. In this event, the duty pump will be stopped and the SECONDARY COOLING DEMAND signal will be removed from the primary cooling system.

PLANT MONITORING AND GENERAL CONTROL INTERLOCKS

Primary Circuit Failure Software Interlocks

11 In the event that both chiller primary chilled water circuit or condenser water circuit circulating pumps fail, the AHU secondary CHW circuit will be shutdown as described in the system 200 narrative description of operation.

Hardwire Interlocks

12 In the event of a packaged chilled water pressurisation unit low-pressure condition, the AHU secondary CHW circuit pumps are shutdown. This interlock is additionally hardwired. Refer to system 200 narrative description of operation **CHW Circuit Pressurisation Unit** for interlocking details.

13 In the event of the chiller safety circuit operating, the AHU secondary CHW circuit pumps are shutdown. This interlock is additionally hardwired. Refer to the system 200 narrative description of operation **Chiller Safety Circuit** for interlocking details.

14 The hardwired interlocks to the pumps will operate whether the selector switches are in the 'test' or 'auto' positions. The system software will duplicate the hardwired interlocks to prevent unnecessary alarms.

Pump Failure and Rotation

15 The pumps have beem arranged for duty/standby operation, with the duty selection being changed on a weekly basis, with changeover taking place by the changing of the duty selection point when the pumps are off.

16 The pumps are monitored for individual running status', with a common differential pressure switch, piped across both pumps and wired in series with an auxiliary contact on the respective pump's starter.

17 Following a pump start command, the failure alarm for the pump, derived from a mismatch between the pump command and its running status, is inhibited for a period of 20 seconds, allowing time for the pump to run up to speed.

18 In the event of a pump failure, as detected by a mismatch between the BMS command to the pump and the pump status, an alarm is raised on the BMS operator's station and the pump commanded off. A software flag for the failed pump will be set.

19 If the duty pump fails, the standby pump will be immediately started and the duty point will be changed to make that pump the duty pump. The automatic timed duty changeover is inhibited until the failure flag

for the failed pump has been reset by an operator.

20 If with one pump failed, the other pump of the pair fails, an additional alarm indicating both pumps failed is raised, which will only clear when one or both pump failed flags for the pair have been reset. The SECONDARY COOLING DEMAND signal will be removed from the primary cooling system.

Plant Re-start Sequence

21 The plant is interlocked, through software, to sequentially restart following:

1. Fire alarm shutdown.
2. Safety Circuit Shutdown.
5. Pressurisation Unit Shutdown.

D.1.40 Residential Controls - Systems 300 to 308

GENERAL

1 There are 6 residences located on the sixth and seventh floors of the building. Each residence has its own small plantroom boiler containing a boiler with an associated primary circuit and pump, an HWS secondary circuit with an HWS cylinder and pump, a radiator/towel rail secondary circuit and pump, and a bathroom underfloor heating secondary circuit. The underfloor heating secondary circuit serves a packaged tertiary circuit complete with three-port mixing valve and controls to achieve a reduced underfloor flow temperature. An extract fan ventilates the boiler plantroom.

2 For each residence, with the exception of the kitchens and the bathrooms, all the rooms are temperature controlled via a ceiling mounted VRV heat pump system, with the condenser units located on the roof. Rooms with VRV units are supplied with tempered fresh air when their associated VRV unit runs by a number of fans, each with their own electric heater battery.

All 6 residences are controlled in exactly the same manner, with room configurations being the only differences.

Refer to the Residence O & M Manual for further information

D.1.41 Public Health Monitoring - System 400

GENERAL

1 The BMS monitors the public health equipment points listed in the equipment schedules for status and alarms.

2 Monitoring equipment associated with system 400 is housed in MCC B/1.

D.1.42 Electrical Monitoring - System 100

GENERAL

1 The BMS monitors the electrical equipment points listed in the equipment schedules for status and alarms.

2 The terminals for BMS indications from the two electrical switchboards monitored by the BMS is located in a separate marwilling chamber for each switchboard.

3 Monitoring equipment associated with system 100 is housed in MCC B/1.

Power Failure

4 In a power failure situation, all power is lost until the generator comes "on line". Once the generator is on line the MCPs are supplied with power, and the BMS will hold off all plant until it has ascertained from the monitoring inputs whether it is being powered by the mains or the generator. If the generator, then all non-essential plant will remain shutdown to avoid overloading the generator.

5 All essential plant, as listed below, is then allowed to operate as normal.

ESSENTIAL PLANT	
MCC/MCP	SYSTEM
MCP1	10, 11 &12
MCP2	4, 5 & 6
MCP3	8 & 20
MCP4	7, 9 & 21

6 Any safety related equipment such as gas detection, safety circuits, pressurisation units etc also remain powered as normal.

7 Any monitoring only functions also continue to operate under generator power.

D.1.43 Fire Operation - System 999

GENERAL

1 The BMS interface to the fire detection system is via a number of FIOUs (Fire Interface Output Units) provided locally to each MCC or MCP. Each FIOU provides a volt-free contact, which represents an action to be taken in the event of a fire as detailed below.

2 All stopping and starting of plant is via hardwiring within the MCC/MCP, not through software, though software should either mimic the hardwired action or disable failure alarms and failure flags to prevent the plant generating secondary alarms and allow the plant to restart automatically on a return to normal.

E

E.1 MAINTENANCE OF THE INSTALLATION

E.1.1 General

Only a regular and organised scheme of maintenance work, planned to cover all details of the installation, within given maintenance periods, can ensure continued satisfactory operation with a minimum of liability to interruptions to supply due to equipment faults.

careful attention must be given to securing the safety of personnel and equipment while maintenance or repair work is in progress. A code of safety rules based on a "permit to work" system similar to that detailed in British Standard Code of Practice CP1008 (1958) Section 11, is recommended.

A planned maintenance scheme should include a system of logging so that records are kept for inspection, maintenance and repair on all items of plant and equipment.

Where maintenance work is in progress, a DANGER notice must always be attached to any LIVE equipment. A CAUTION notice must always be attached to the plant or its associated control equipment which may be occasioned by interference.

Before any work is commenced on any item of equipment, the supply ancillary circuits must be made DEAD and locked off.

When working on medium and low voltage switchgear, it is recommended that caution notices and adequate screens are used and voltage indications are used to prove that the apparatus is dead before any work is commenced.

Where it is necessary to work on LIVE low voltage or medium voltage switchgear, steps must be taken to guard against shock and short circuit by the use of insulating strands, screens, boots, gloves and tools as may be necessary. These should be maintained in a sound condition and checked immediately before use.

Only fully insulated hand lamps with non-metallic guards should be used. Danger and caution notices in the vicinity of LIVE CONDITIONS should be non-metallic.

Any plates fitted to equipment giving operating instructions should be maintained in a legible condition.

E.1.2 Operation of Switchgear During Maintenance

It is important that maintenance personnel should be fully familiar with the operation of the various devices that they are called upon to handle. In correct or unauthorised operation of switchgear during maintenance is when most accidents and problems occur.

Make sure that all staff are aware of what work is being carried out and that the switching operations are in accordance with the manufactures recommended instructions and that voltage is not applied to incomplete or un commissioned systems.

All voltage indicators should be tested on a known LIVE source immediately before and after use. The use of improvised indicators should be discouraged.

E.1.3 Pre-Maintenance Checks

Before any work is carried out on or near components which are normally live, or where danger would arise to men working, it is essential that the apparatus to be proved dead.

The operation of an external handle or lever of an isolator or circuit breaker should not be assumed to have opened all or any of the contacts, as cases of mechanical failure have been known to occur. In particular, this may happen where a handle is operated against a mechanical interlock.

Tests should be therefore be carried out to ensure that the equipment is dead, that all the contacts of the device are open and all the correct fuse carriers removed. These should include tests between each phase and earth to cover the possibility or wrong connection.

E.1.4 Operation Of Live Equipment

If it is necessary for live equipment to be observed with the covers removed while operating, only authorised persons should be permitted to do this and no one should do this work alone. The companion to the authorised person should be made aware before hand of exactly what work has to be done and what he should do if an accident occurs.

E.1.5 Maintenance Of Earthing Connections

All equipment other than those of the all insulated type, should be adequately earthed. It is very important to ensure that earthing connections are mechanically sound, free from corrosion and that all contact screws are tight making good contact.

After maintenance, all bolts and screws should be replaced, together with any locking screws.

E.1.6 Precautions Regarding Auxiliary Circuits

Precautions should be taken to ensure that circuits controlling automatic equipment are disconnected from the supply before work is commenced.

It should not be assumed that the isolation of the main supply to the equipment isolates auxiliary circuits.

All safety precautions and general recommended procedures relating to the maintenance of switchgear are contained in British Standard Code of Practice CP 10 (1958) and this should be read in conjunction with the instructions for routine periodic maintenance given in the following pages.

E.2 MAINTENANCE NOTES & SCHEDULES

E.2.1 Frequency Of Maintenance

For the purposes of this manual the normal anticipated periods have been assumed but this does not preclude more frequent checks and/or maintenance should it be found necessary from experience.

For continually operating equipment, it may be necessary to co-ordinate routine maintenance with the demands on building usage, but where there are regular periods during which the system is shutdown, maintenance schedules may be arranged to coincide with these periods.

E.2.2 Switchgear

For equipment to operate satisfactorily, it is essential that it is kept clean. Before removing covers and opening doors, loose dirt and dust resting on the top of enclosures should be removed with a brush.

When air is used for cleaning, a suction type device with a dust receptacle should preferably be employed.

Cleaning down by air blowing is not preferred as it spreads contamination. If it is necessary to use compressed air, it is preferable to employ a portable type blower.

If rags are used they should be chemically clean and free from loose fibres. Cotton waste should not be used.

When solvents are used for cleaning or degreasing they should be of a non-flammable and non-toxic nature whenever possible, and at all times precautions against fire should be observed.

After maintenance work, all covers and doors including those of instruments and relays should be securely replaced so as to exclude dust.

E.2.3 Electrical Checks

Regular checks of the tightness of all termination's and connections are required in the switchgear including those on the main busbar system.

Check the instrumentation and controls for correct operation and replace fuses and switches as necessary.

In addition, vacuum cleaning of the interior of the switchgear whenever possible is desirable.

E.2.4 Marking Of Covers and Connections

All covers, cables and shields etc. should be marked carefully before removal to ensure correct replacement. If connections are disturbed or temporary connections made for testing purposes, they should be clearly marked, to facilitate reconnection and the permanent connection must be restored and the temporary connection removed before the unit is returned to service.

After maintenance work, bolts, screws, and locking devices of all current carrying/earth connections should be securely replaced.

Connections which have not been disturbed should be checked for soundness. It is not sufficient for nuts and bolts to be assumed to be tight.

E.2.5 Switches and Fuses

Circuit wiring and terminal connections must be checked for signs of overheating, replace parts where there is the slightest doubt that this has occurred.

Where cartridge fuses are used, replacements should be of the same type and pattern as the original and in no circumstances should attempts be made to use, permanently or temporarily, any other fuse device.

Where a locking device holds the fuse in position, it should be remembered that fuse links incorrectly chosen or badly fitted may contribute to overheating.

Knife contacts should be slightly smeared with petroleum jelly or other suitable lubricant but should never be lubricated with either grease or oil.

E.2.6 Control Circuit Fuses

The reliability of equipment can be seriously impaired by control faults and its is therefore most important to locate and correct immediately any which causes the operation of any control circuit fuse and to report the occurrence.

Every fuse link should be tested for continuity each time a routine inspection is carried out, where this is not inevitably part of the final running test.

Clear labelling of fuses in agreement with connection diagrams is also desirable. Such labelling should also indicate the fuse ratings.

E.2.7 BMS Network Testing

This section is provided as fault finding guide in the event of a Network Communications failure, as opposed to routine testing and may be used as a commissioning guide for any future extension to the system.

The task of testing/commissioning a network is not difficult, but because of the speeds used are too fast for the message transmissions to be seen on the node LED indicators, care should be taken during the initial stages.

Step 1

Set up the addresses of all network nodes (i.e. outstations/network controllers) and identify the network 'map' i.e. the order in which the messages will travel from one nodes output to the next nodes input and so on. A record should be kept of the node sequence, as the LAN connections are terminated.

Step 2

With the LAN speed on all nodes set to 19k2, connect power to the nodes, and wait two minutes. This will enable the LAN's monitoring facilities to self configure. If all connections between nodes are sound, the "NETWORK OK" LED indicator on each node will illuminate, and the LAN wiring test is complete.

Step 3

Failure of the NETWORK OK indicator to illuminate indicates either a break in the network wiring, or failure to maintain communications at that speed.

If a LAN BROKEN alarm is printed by a Supervisor at this stage, it is from the node connected immediately 'downstream' of the problem, i.e. the node that is not receiving any network test messages. If the address of that node is checked against the network "map" it will be easy to identify from which node to begin testing. If this node has its "RX" LED off, then there is a wiring fault - proceed to step 4. If the "RX" LED is on, then there is either an intermittent fault, or the LAN cannot work at that speed - proceed to step 5.

Step 4

If the LAN wiring is broken down, the next step is to look on the nodes for TX and RX LED's that are not illuminated. If there is break in the LAN, there should be a "matching pair" of one of its "TX" LED off, and one node with its "RX" LED off. This will probably be due to a wiring fault between the two nodes.

If only one such node is found initially, the network map described in step 1 will enable the other to be found quickly.

A cable short circuit can also cause the TX LED to illuminate, without a corresponding RX LED.

Step 5

If step 4 reveals no wiring faults, i.e. all "TX" and "RX" are illuminated, then there is a problem transmitting from one node to another which is stopping messages from passing around the LAN. The alarm mentioned in step 3 will indicate which link is causing problems, but it is not a simple case of changing the speed that those two nodes run at. All nodes on a network must run at the same speed, and hence all the nodes should now be set down a speed.

Step 6

Wait for two minutes, and continue as for step 2 at the reduced speed until the NETWORK OK indicators illuminate.

E.2.8 Maintenance Programe

EQUIPMENT	3 MONTH	6 MONTH	EACH YEAR	3 YEARLY
Control Panels	*	*	*	*
Panel Equipment (Starters)		*	*	
Panel Equipment (General)	*	*	*	
BEMS (Communications)			*	
BEMS (Outstations)			*	
BEMS (Software Functions)			*	
Field Controls (Valves)		*	*	
FieldControls (Damper/Valve Actuators)			*	
Field Controls (Switching Devices)		*	*	
FieldControls (Temp/Humidity Sensors)	*	*	*	

E.2.9 Control Panels

When working on, or testing control panels, it is essential that all local and national statutory regulations should be observed at all times.

In particular, the following documents should be adhered to:-

(i) Health and Safety at Work Act (1974)
(ii) Electricity at Work Regulations (1989)

Note: The guidelines within this manual refer only to equipment/supplies operating up to 400 volts.

Ensure that all remote circuits associated with the switchgear are positively isolated before any work is carried out. The isolation should be secure either at the point of work, or padlocked remotely to prevent anyone else switching on whilst work is in progress.

Never assume any circuit to be dead. Always use proven test equipment, i.e. a voltage tester should first be checked on a known live source immediately before and after use.

Whenever cables are disconnected from switchgear during maintenance or replacement, ensure that the cables are suitably insulated and identified for correct reconnection.

Visually inspect to ensure plant is operating as expected. Check that any meters fitted show a correct reading, and any timers are set at the correct operating time. Check readings against a known source.

Appropriate Safety Guides:-

- HSE Guidance Note GS38 (Electrical Test Equipment For Use By Electricians)

- HS(G)13 - Safety in Electrical Testing

- HS(R)25 - Memorandum on Guidance on the Electricity at Work Regulations (1989)

Control Panels

	3 MONTHLY
1	Check panel exterior for physical damage, making necessary replacement.
2	Check door locks for security and locking arrangements.
	6 MONTHLY
1	Main supply and cubicle isolators to correct mechanical and electrical operation, lubricating any moving parts as required. Adjust door interlock mechanism if necessary.
2	Check fuses/carriers for signs of overheating, and ensure tightness of connections. Check fuse ratings against circuit diagrams.
	12 MONTHLY
1	Incoming power supplies - measure each live to earth, and each live to neutral. Record readings and ensure that values are within electricity suppliers specification.
2	Busbar system - isolate supplies and inspect for signs of overheating, damage, or burnt cables. Inspect mechanical support systems and adjust fixings if necessary. Check tightness of cable to bar connections.
3	Panel Wiring;- Inspect for signs of overheating or burn marks. Replace any suspect conductors Check all connections, termination's, earth cables and links for security and tightness. Check all panel is correctly earth bonded, (test continuity and record readings).
	36 MONTHLY
1	Flash test between 1.5kV - 3.0kV to detect potential deterioration of system, taking care to isolate sensitive equipment.

Panel Equipment (Starter)

	6 MONTHLY
1	Overload units - check settings of all thermal overload relays against actual running current of motors, record any alterations from records.

	12 MONTHLY
1	Overload Units:- Inspect for signs of overheating. Check electrical connections for tightness and security. Operate the trip/test facility, ensuring that the switchgear de-energises in a clean positive operation. Check for single phasing protection by operating the starter with one power fuse removed. During testing of overloads, ensure that the panel facia indication operates correctly.
2	Starters:- Inspect electrical and mechanical interlocks between contactor pairs (e.g. Star/Delta or High/Low). Check for correct start up sequence of Star Delta starters. Inspect and adjust as necessary the setting of the timer to match characteristic of motor overload. Refer to the manufacturers guidelines for details of contactor maintenance (e.g. cleaning of contacts).

Panel Equipment (General)

	3 MONTHLY
1	Check operation of indicator lamps by operating the associated circuit. Replace blown or discoloured bulbs, ensuring that the type, voltage and power rating are in accordance with the manufacturers specification.
	6 MONTHLY
1	Inspect lamp holder assemblies for signs of overheating or insulation breakdown.
2	Voltmeters/Ammeters;- Inspect and check for correct mechanical/electrical operation, using an independent measuring device. Check for unimpeded movement.
	12 MONTHLY
1	Control relays/timers:- Inspect for excessive wear of contacts. Inspect coil for signs of overheating or insulation breakdown. Operate relay (electrically) and ensure clean operation. Inspect relay connection pins for signs of burning, replacing as necessary. Inspect relay base for signs of overheating or arcing.
2	Selector switches/pushbuttons:- Inspect both mechanical and electrical operation, ensuring a free and clean movement in its action. Check switch/push-button for particular application.

E.2.10 Building Energy Management System.

The Building Energy Management System can provide considerable energy and cost savings if properly maintained. The benefits of such an investment could be lost, wasting energy and increasing costs if maintenance of the system is not undertaken by specialist trained personnel who have the support of the product manufacturer.

It is recommended that maintenance staff have had the appropriate training, to ensure that routine but important maintenance tasks are carried out satisfactorily.

Such tasks include monitoring and revising time schedules, setpoints and environmental control settings, and simple routine maintenance tasks are carried out satisfactorily.

Where software routines are altered, for whatever reason, it is essential that backup copies are made to safeguard the changes. This should include revision of all relevant flow charts, points schedules and graphics within this manual.

E.2.11 Maintenance Contractor

For the regular maintenance of the equipment, the client should be satisfied that the maintenance contractor employs BEMS specialists who:-

- Have had the necessary training.
- Have a knowledge of the installed system.
- Maintain an up-to-date awareness of the manufacturers equipment, including computer hardware and software.
- Have access to up-to-date diagnostic equipment.
- Have good technical support.
- Are supported by an adequate spares stock.

Building Energy Management System (Communications)

	12 MONTHLY
1	Data Communications:- Check operation and visually inspect Supervisor, and modem (if installed). Ensure environmental conditions are within prescribed limits. Supervisor/printers - check operation and visually inspect. Supervisor/outstations - check integrity of data flow in both directions. Supervisor/network controllers - check integrity of data flow in both directions. Check security and integrity of all data connectors, including sign of damage.

Building Energy Management System (Outstations)

	12 MONTHLY
1	Check for signs of physical damage (which may not have manifested during operation)
2	Ensure that environmental conditions are within manufacturers specified limits
3	carry out voltage check to power supplies, including check of automatic restart and re-booting of software programme.
4	Digital Inputs - check by activating (from sensing or control device), taking care to isolate local operation.
5	Digital Outputs - check operation of output by operating routine. Check switching by software interlocks.
6	Analogue Inputs - read and check calibration of

	analogue inputs.
6	Analogue Outputs - check accuracy of output signal.
8	Manual overrides (physical) - check status.

Building Energy Management System (Software Functions)

Control loops - the frequency of this exercise should be related to the critical nature of the operation being performed, but should include :-

- Check integrity of installed programme
- Check sequence and operation of control outputs
- Check stability of plant

	12 MONTHLY
1	Optimised start/stop - control strategies may require updating to suit revised occupational requirements. Verify operation by interrogating software/hardware copy.
2	Timeclock - check accuracy of real timeclock throughout the system.
3	Time switching - review current time schedules according to clients needs.
4	Data logging - review existing logs.
5	Alarms (e.g. faults, out of limits alarms, mismatch conditions etc.). Check that the plant alarms and software interlocks with safety implications are operating correctly. Check alarm priorities, routings and reactions. Review system of reporting outstanding alarm conditions and report discrepancies.
6	Alarm management - review frequency of generated alarms, reporting to client as necessary.
6	Power failure - check plant start-up sequence.
8	Software interlocks - verify operation

Field Controls (Valves)

	12 MONTHLY
1	Operational status - operate and check for correct travel, referring to manufacturers literature. (Refer to 6.4.10 for motor actuators).
2	Ensure that valve is not letting by excessively.
3	Inspect for spindle gland leakage, referring to manufacturers maintenance instructions. Replace leaking O rings if necessary, and inspect spindle for wear.
4	Inspect for external deterioration, such as signs of corrosion or mechanical damage.

Field Controls (Damper/Valve Actuators)

	6 MONTHLY
1	Ensure that actuators assume correct position in response to fire/smoke or other safety signals (spring return action where applicable)
	12 MONTHLY
1	Check operation/accuracy of auxiliary switches and/or feedback potentiometers.
2	Manual Operation - check to prove actuator will mechanically open/close valve or damper to its working limits. Ensure that the actuator is returned to the AUTO position after check is completed.
3	Ensure that the actuator responds correctly to control signal(s)
4	Check running time against manufacturers data sheet, including spring return where applicable.

Field Controls (Switching Devices)

	12 MONTHLY
1	Thermostats:- Ensure thermostat is not affected by local heat sources, introduced since original installation. Clean and check operation, including contact fuses. Check and report if significant variation to recorded setpoint is found. Check calibration.
2	Differential Pressure Switches:- Check and report if significant variation to recorded setpoint is found. Check sampling lines for damage/obstruction, cleaning as required. Check calibration.
3	Level Switches:- Clean and check for correct operation. Check and report if significant variation to recorded setpoint is found.

Field Controls (Temperature/Humidity Sensors)

	6 MONTHLY
1	Humidity Sensors:- Check for obstructions to sampling points. Ensure that sensor is free from dirt.
	12 MONTHLY
1	Temperature Sensor:- Check for obstructions to sampling points.

	Ensure that sensor is free from dirt. Check for correct operation and calibration. Check immersion sensor pockets for leaks, and ensure good thermal contact using heat transfer grease or spring system as appropriate.

E.3 HOLDING SPARES

E.3.1 General

The quantities in which various spares should be held is dependant on the number of components covered by each spare, the frequency at which it is likely to be required, the priority of the function it covers, its initial cost and its availability.

The frequency at which spares are required can be estimated for wear items but not for items required to cover failure. The initial cost of the item should be judged in respect to the priority of the function it covers and its availability.

In order to prevent deterioration, all spares must be stored in clean dry conditions. Manufacturers recommendations must be followed with respect to any requirements with regard to protection, stacking, etc

E.3.2 Spares Lists

Panel Equipment

DESCRIPTION	MANUFACTURERS PART NUMBER	RECOMMENDED STOCK LEVEL
Lamp Lenses	BJ-Red	2
	BJ-Green	2
	BJ-White	2
Lamp Bodies	TMU/240/4	2
	TMU/24/4	2
Contactors	LC1.D09.10U5	1
	LC1.D12.10U5	1

Control Relays	55.34 (240v) 55.34 (24v ac)	2 2
Transformer - 240/24V	200VA	1

B.M.S. Equipment

DESCRIPTION	MANUFACTURERS PART NUMBER	RECOMMEND STOCK LEVEL
Input Card	EIN	1
Analogue Output Card	EAO	1
Digital Output Card	EDO	1

Field Equipment

DESCRIPTION	MANUFACTURES PART NUMBER	RECOMMENDED STOCK LEVEL
FCU Controller	CZU 3201	3
Valve Actuators	AVUE 3304	5
FCU Return Air Temperature Sensor	DDU 1803	5
Duct Temperature Sensor	TDTDS/S	1
Immersion Temp. Sensor	TDTIS/S	1
Diff. Pressure Switch (Air)	930.83-ATP	1
Diff. Pressure Switch (Water)	SP-007	1
Damper Actuators	SM-24	1
	SM24-SR	1
	LM24-S	1

F

F SYSTEM RECORDS

F.1 EXPECTED SERVICE LIFE

Each Contractor is required to list, where available, details of the expected service life all components.

F.2 DISPOSAL INSTRUCTIONS

Each Contractor is required to provide information for COSHH requirements and the compiling of a COSHH register detailing:-

1. *any known dangers likely to arise during the disposal of specific items of plant or equipment together with the necessary precautions and safety measures.*

2. *methods for safely disposing of or destroying the equipment or any parts thereof, including packaging insulation and fluids.*

3. *sources from which further advice can be obtained.*

Each COSHH substance identified should have an individual data sheet providing the above information in a common format.