



**Delap & Waller**

**DAN BREEN HOUSE,  
TIPPERARY TOWN,  
Co TIPPERARY.**

**MECHANICAL PARTICULAR  
SPECIFICATION**

Project No: 22195

Date: 22/08/2025

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# Revision History

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# 1. DEFINITIONS

In reading the General Conditions of Contract, and the Specification, and any other documents connected with them, the following terms shall have the meaning herein assigned to them.

<b>THE EMPLOYER:</b>	Tipperary County Council, Civic Offices , Rosanna road, Tipperary Town Co Tipperary,
<b>THE ARCHITECT:</b>	Robin Lee Architecture, 71 Queensway, London, W2 4QH United Kingdom
<b>THE CONSULTING ENGINEERS SERVICES:</b>	Delap & Waller, 1st Floor, Bloomfield House, Bloomfield Avenue, Dublin 8
<b>THE QUANTITY SURVEYORS:</b>	Sammon, 20 Ely Place, Dublin
<b>THE CONSULTING ENGINEERS STRUCTURAL:</b>	CORA Consulting Engineers Ltd., Behan House, 10 Lower Mount Street, Dublin 02
<b>THE SPECIALIST:</b>	The Tenderer whose tender for the works here in specified is accepted by the Engineer.
<b>THE MAIN (BUILDING) MAIN SPECIALIST</b>	The Building Main Specialist appointed by the employer to carry out the building works.
<b>THE CONTRACT:</b>	Shall mean the General Conditions of Contract, Specification, Drawings, Tender, Contract Agreement and priced Schedule of Works.

## 2. PROJECT DETAILS

This Particular Specification shall be read and construed in conjunction with the General Contract Conditions, the General Specification for the Mechanical Works, and the Contract Drawings.

### 2.1 SITE LOCATION:

The site is located Dan Breen House, Davis St, Murgasty, Tipperary Town, Co. Tipperary.



*Figure 1 – Dan Breen House*

### 2.2 PROJECT DESCRIPTION:

Dan Breen House, grounds and stables built as the Rectory in 1860 and was originally walled of and could be used to directly reach St. Mary's Church through the orchards, gardens and grounds.

The project will encompass the refurbishment of the existing main building, demolition of the old library extension, design of a new extension matching the builder users' requirements, design of ancillaries such as outbuildings to be repurposed as workshop/training areas and landscape design.

When the project is complete Dan Breen House will be repurposed and transformed into a youth services, education and training hub providing high quality, fit-for-purpose multi- functional space

### **Recommended Conservation Repairs ,refurbishment and new build**

The following recommended repairs are intended to augment whatever recommendations are made by the design team in considering the redevelopment of the Market House for its new use.

All new building services are required, including new wiring, plumbing, and heating, throughout. New fire alarms and emergency lighting will be required, along with whatever lighting and electrical services are required for the proposed new uses.

### **3. PROJECT PRELIMINARIES:**

#### **3.1 INSURANCES**

This Specialist shall include within his tender for all necessary insurances as required by the Main Contract Documents.

#### **3.2 INSTRUCTION OF EMPLOYERS PERSONNEL:**

This Specialist shall instruct the Employers staff in the operation and maintenance of the various components forming part of the installation. He shall prepare maintenance / operation manuals detailing the level of maintenance required and the frequency that this maintenance shall occur.

#### **3.3 SAFETY, HEALTH & WELFARE AT WORKS:**

This Specialist shall include all requirements associated with the Safety, Health and Welfare at Work Act 2014 and Safety, Health, and Welfare at work (Construction) Regulations, 2006 (SI 504) as detailed in the main contract documents.

#### **3.4 BUILDING REGULATIONS:**

This Specialist shall be deemed to be familiar with and have a full understanding of the latest set of Building Regulations and with the contents of all technical guidance documents to the Regulations. He shall ensure that all works are undertaken and completed in accordance with the Current Building Regulations.

#### **3.5 TIME FOR COMPLETION / PROGRAMME OF WORKS:**

This Specialist will be required to produce as lead services co-ordinator a detailed programme showing key tasks and durations. The programme shall be fully co-ordinated with the electrical Specialist and Main Specialist.

#### **3.6 OWNERSHIP OF GOODS AND MATERIALS**

The Engineer may ask this Specialist for proof of full ownership, free from line or charge, for all goods and materials delivered on site, and to be embodied in the works. If this proof is not forthcoming, the Engineer will be entitled to withhold certification of payment in respect of the goods and materials.

#### **3.7 TAX CLEARANCE CERTIFICATE:**

This Specialist shall provide a Tax Clearance Certificate as required in the contract documents.

#### **3.8 PENSION / SICK PAY SCHEME:**

This Specialist must be a fully paid-up member of the Construction Industry Federation Pension and Sick Pay Scheme as detailed in the main contract documents.

### **3.9 WORKMEN:**

Only fully qualified and competent workmen shall be employed on the works and this specialist shall provide all necessary evidence to confirm the qualifications and competence, of any workman. This Specialist shall ensure that all people employed on the works are registered for PAYE and PRSI.

### **3.10 LOCAL LABOUR:**

Persons engaged upon the works should in so far as is practicable, and without affecting the efficiency of the work, be recruited from the local offices of SOLAS to the extent that the total labour requirements of the contract exceed this Specialist core workforce.

### **3.11 TRADE NAMES:**

Where Trade Names or Manufacturers Names, or marks, are used, they shall be deemed to include the words, 'or equal and prior approved', alternatives to the items specified or shown or scheduled, may be accepted, provided that in appearance, workmanship, quantity, performance and durability, it is at least equal to the product specified or shown.

### **3.12 PRICING DOCUMENTS:**

Upon receipt of the completed Tender Summaries and Form of Tender, the lowest Specialist(s) will be requested to submit their detailed pricing documents. This document must reflect accurately the elemental breakdown of quantities and rates as tendered.

The pricing documents shall be submitted within three working days to the offices of the Client representative.

The pricing document shall be broken down in elemental format with rates for all individual items of equipment, boilers, heaters etc., rates per metre installed for pipework, ductwork etc. The accumulated total must equal the total tender price.

### **3.13 INDEMNITY**

This Specialist must note and must include in his tender, and in the works, for indemnifying the Main Specialist, in accordance with the requirements of the (to be confirmed), Conditions of Contract.

### **3.14 SITE PROGRESS MEETINGS**

This Specialist shall include in his tender, and in the works, for attendance at weekly site meetings and at progress meetings as required and as determined, by the Main Specialist.

### **3.15 DEFECTS LIABILITY PERIOD**

Upon notification to the employer of any defects, or breakdowns, such defects must be attended to and made good, or remedied, within the period stated, or as may be agreed with the Engineers.

(a) Any defects or faults that, in the opinion of the Engineer, impose immediate risk to health or safety, must be made good within 24 hours of notification, and confirmed on completion to the Engineer.

(b) The following defects must be made good within 3 days of notification.

(b.1) Service defect.

(b.2) Any defect that may cause discomfort or nuisance to the occupant.

(b.3) Any defect that may result in the property being insecure against unauthorised entry or access.

## 4. SCOPE OF MECHANICAL SERVICES:

The Mechanical services installation comprises the following services: -

Element 50	–	Site Services Installation.
Element 51	–	Heating Centre Installation.
Element 52	–	Soils & Waste Installation.
Element 53	–	Water Services Installation.
Element 54	–	Gas Services.
Element 56	–	Space Heating Services Installation.
Element 57	–	Ventilation Services Installation.
Element 58	–	Protective Services Installation.
Element 59	–	Building Management System/Controls.

### 4.1 DRAWINGS:

The contract drawings issued with this specification are as scheduled (See Drawing Register). The drawings include the approximate location of the various outlets and fittings. The final locations must be marked on site by the Specialist, and approved with the Engineers, prior to installation.

The Specialist shall keep on site a full set of drawings, on which he shall mark and record all alterations, changes and variations, additions, and omissions. He shall keep these drawings up to date during the course of the installation works.

### 4.2 WORKING DRAWINGS:

This Specialist shall provide Dimensioned Working Drawings as follows, with a minimum scale of 1:100, at least one month before installation work of the appropriate service commences.

- (a) Details of builder's work requirements for all Mechanical work.
- (b) Details of installation arrangements for all Mechanical work.
- (c) Shop drawings for ductwork, plant layouts.

These drawings should be fully co-ordinated with all other trades.

The Mechanical Specialist will act as lead co-ordinator for all services drawings. Electrical builder's work and installation drawings will be provided by the Electrical Specialist.

### **4.3 RECORD DRAWINGS:**

This Specialist shall submit, on completion of the works, and at practical completion stage, a full set of as-installed drawings, showing the final layouts of all service systems, and details, as actually installed. Drawings shall be in AutoCAD disk format and shall be submitted to the Engineers for approval. This Specialist shall carry out any amendments requested by the Engineers.

On final approval by the Engineers, he shall prepare and submit to the Engineers, a full set of drawings, for all service systems, showing the final as-installed layouts in AutoCAD format and in hard copy - three sets.

### **4.4 CO-ORDINATION OF SERVICES:**

The Mechanical Specialist shall lead co-ordination of the building services installations, including electrical services drawings. The Mechanical Specialist shall liaise with the Electrical Specialist regarding final routes of distribution systems and shall ensure all drawings issued by these Specialists do not conflict with other services or building works. The Mechanical Specialist shall include in his costs for complying with this item. The Electrical Specialist shall also include for liaising with the Mechanical Specialist.

### **4.5 BUILDERS WORK:**

Builders work in connection with the contract works such as cutting or drilling of holes, chases in walls, floors, and ceilings, trenching, etc... will be carried out by the Main Specialist under the terms of the main contract. This Specialist shall be responsible for the correct marking out of all attendances, and all other cutting to be performed by the Main Specialist.

Dimensions, levels, and alignment of pipe runs, sleeves, brackets, supports and equipment shall be marked out well in advance of all such work required to be performed by the Main Specialist.

The Main Specialist shall provide the following attendances: - mess rooms, sanitary accommodation and welfare facilities, space only for office accommodation and space only for storage of plant and materials; provision of light and water and of electrical power, clearing away rubbish; protecting completed work; forming holes, pockets, mortices, and chases in the structure and making good.

The attendances outlined below will not be provided by the Main Specialist and this Specialist shall provide and shall include in his tender price for these attendances: - taking delivery, unloading, and storing materials, hoisting materials and placing in position. Office accommodation and storage for materials and plant, provision of all scaffolding and ladders, for use by this Specialist, drilling, plugging and shot nailing for fixing. Cranage of any equipment shall be the Main Specialist's responsibility.

This Specialist shall be responsible for removing all of their own rubbish off site on an ongoing basis.

### **4.6 ELECTRICAL WORK & ELECTRICAL SUPPLY:**

Electricity supply shall be 230/400/50 cycles, three phase, and all electrical plant and equipment whether of a permanent or temporary nature, supplied by this Specialist for use on the works, shall be suitable for the supply. All electrical motors associated with the Mechanical equipment shall be supplied and installed by the Mechanical Specialist. The Electrical Specialist shall furnish all starters, contactors, isolators etc.,

required for all such equipment. The Mechanical Specialist shall supply the Electrical Specialist with the necessary information as required to enable the Electrical Specialist to obtain suitable equipment. All electrical work associated with the Mechanical Contract, such as wiring up of control equipment, motor, etc., will be carried out by the Electrical Specialist. The Mechanical Specialist shall supply all necessary wiring diagrams of control equipment and all other plant supplied by him.

#### **4.7 CONTRACT WORKS:**

The Contract works shall be carried out with best quality plant, equipment, materials and workmanship in the manner specified and shall be installed, connected up, tested and left in complete operational order to the Engineer's satisfaction, in accordance with the meaning of this Specification. Any equipment, appliance, material or work not shown on drawings but mentioned in the specification or vice versa or any incidental accessories necessary to make the work complete and perfect in all respects, and ready for operation, even if not particularly specified, but necessary for the proper installation and operation of the work, shall be included in the work, and in this Specialist's tender, the same as if specified or shown.

This Specialist is to take all reasonable precautions to minimise nuisance to the occupants / users of adjoining properties and the general public and to include for complying with all statutory regulation in this regard.

#### **4.8 MATERIALS:**

Materials and goods shall be of the best quality of their respective kinds and shall comply with the appropriate Irish or British Standard, Code of Practice, unless otherwise stated. Where materials or components are specified to comply with a Standard Specification, the relevant standard number shall be marked on the material itself, or on a delivery note accompanying all materials. In general references to Irish or British Standards, and Codes of Practice, do not give the year of issue or dates of amendments, and its latest relevant published version, including amendments published at the date of tender, shall apply. The current edition at the date of tender shall apply in all cases.

Manufacturer's certificates shall be provided in respect of materials, when requested. If proprietary names are used, they shall infer the standard required and the term "or other equal and approved" shall be deemed to be included.

Samples of materials and executed works shall be submitted as required to the Engineers for their approval, before inclusion in the works and articles not so approved shall be removed, if so directed. Approval of any materials or work will not relieve this Specialist from responsibility for defects subsequently arising. All unfixed materials shall be carefully stored in accordance with the best practice, and in a suitable location on site. Manufacturer's recommendations regarding storage shall be adhered to.

Where materials or fittings of special design, manufacture, or description, patented or otherwise are described, or the names of the manufacturers or agents are given any departure from the specified articles or materials will only be permitted on the written authorisation of the Engineer. If no such authorisation is obtained, this Specialist shall supply the material or articles originally specified.

## 4.9 LABOUR:

Only fully qualified and competent tradesmen, together with their necessary labourers or helpers shall be employed by this Specialist on the works, which shall be carried out and completed in the best and most substantial manner. When the working of overtime is made a condition of employment in any trade, no claim for extra payment will be allowed under this heading.

This Specialist shall provide full and adequate supervision and site administration during the progress of the works and shall keep a competent and authorised Agent or General Foreman, approved by the Engineer, constantly on the works. Such authorised Agent or General Foreman shall give his whole time to the supervision of the works and must be able to receive and act upon (on behalf of the Specialist) all instructions, directions or orders issued by the employer's representative.

## 4.10 DAYWORKS

Dayworks as determined under the Conditions of Contract, shall be accepted as a basis for valuing work, only when the Engineer has issued written instructions to this Specialist to that effect. This Specialist shall submit, to the Engineer, at the end of each month, an application for all dayworks due the preceding month.

Application for payment shall be supported by vouchers for the month, certified by the Engineer, or his representative. Such endorsement shall be deemed to certify that the labour, materials and plant used are correct. Daywork vouchers shall give: -

- (a) Description of the work done.
- (b) Operatives name and trades.
- (c) Rates of wages and hours worked on normal time, productive overtime and non-productive overtime.
- (d) Insurances.
- (e) Quantities of materials used.
- (f) Details of plant used.

All vouchers must be clearly labelled with references to areas, instructions and shall be legible.

## 4.11 DOCUMENTS:

This Specialist shall carefully examine all drawings, schedules, specifications, and other documents, and shall satisfy himself as to their accuracy and that they cover and embody the works as proposed. He shall carry out everything necessary for the full and proper execution of the works whether shown on the drawings or described in the specification.

## 4.12 INSPECTION:

This Specialist shall, before covering up any work, give the Engineers reasonable opportunity to inspect the works already executed. He shall give all such notices and provide such facilities as may be required to Statutory Undertakings, entitled to carry out inspection, or examination of the works or part of the works.

This Specialist shall not interfere with or disconnect or remove any existing services without prior arrangement and without prior agreement.

#### **4.13 SITE INSPECTION:**

The Specialist is strongly advised to inspect the site and examine the Architects and Structural Engineers drawings and specifications during the course of the Tender period to familiarise themselves adequately with the exact nature of the Works. Main Specialist to confirm with their Tender Return that they fully appreciate the exact nature of the works and that they have inspected/reviewed the Architects and Structural Engineers drawings and have visited the Site.

#### **4.14 OPERATING AND MAINTENANCE MANUAL:**

This specialist shall prepare and hand over to the Engineers, two copies of an operating and maintenance manual, comprising.

- a) Distribution of all supplies
- b) Operating Instructions for all systems
- c) Control procedures for all systems
- d) Maintenance instructions for all supplies and equipment.

#### **4.15 RECORD DOCUMENTATION:**

The preparation, completion, and issue of record documentation by this specialist supplier shall comply with that of this Specification.

Controls systems record documentation shall include, but is not limited to, the following: -

- As-installed network drawings
- Commissioning test sheets
- Equipment data sheets
- System operational description
- Manufacturer's operation manual
- Setting sheets
- Suggested spares lists
- Maintenance proposal
- Completion certificate
- Test equipment calibration certificate where necessary
- Control panel factory test certificate

#### **4.16 BUILDING CONTROL (AMMENDMENT) REGULATIONS 2014:**

A works inspection plan shall be applied to this project, in accordance with S.I. No.9 of 2014 and the Specialist shall include for all costs associated with Specialist/sub-Specialist duties required under same.

If in any instance it is found that an item of plant or equipment has been installed that is not in compliance with the agreed installation methodology and/or specification, the Specialist will be required to remove/rectify/replace the installation/equipment/plant in question at no expense to the client.

All works shall be carried out to the new Building Control (Amendment) Regulations [BC(A)R], S.I. 9 of 2014, and therefore the Specialist shall allow for the following over the following stages of the contract:

#### **4.17 COMMENCEMENT STAGE**

- Familiarise themselves with the drawings, specifications and documents lodged with the Commencement Notice
- Ensure a competent person is assigned to oversee the Construction works.

#### **4.18 DURING CONSTRUCTION**

- Install the services and construct the building in accordance with the plans and specifications.
- Ensure that the workmanship complies with the requirements of the Building Regulations.
- Ensure that materials which they select and for which they are responsible comply with the requirements of the Building Regulations.
- Cooperate with the Design Team, the Assigned Certifier, and other Certifiers (Clerk of Works and other Client Technical personnel).
- Cooperate with the Assigned Certifier for the implementation of the site inspection plan and cooperate with any other client inspections.

#### **4.19 CERTIFICATE OF COMPLIANCE (COMPLETION)**

- Sign the Certificate of Compliance (Completion)]
- Provide to the Assigned Certifier, such documents for which they are responsible, as may assist the Assigned Certifier to collate particulars for the purposes of handover and certification, and/or for further submissions to the Building Control Authority.
- Ensure the coordination and provision of all test certificates and confirmations to the satisfaction of the Assigned Certifier or other designated Inspectors or Certifiers providing Ancillary Certificates.
- Maintain records.

#### **4.20 PHOTOGRAPHIC EVIDENCE**

The Specialist shall allow for photographing the mechanical installation on a bi-weekly basis for records. These photographs shall be detailed in a weekly report, which highlights what works were carried out and shall include photographic evidence of that work. These reports shall be submitted to the Building Specialist on a bi-weekly basis for inclusion in the progress report. These reports shall be signed and witnessed by the Building Specialist.

At the end of the project, the Specialist shall include a copy of these reports in the Operation and Maintenance Manual.

The Specialist shall allow for submitting photographic evidence on the following over the course of the project:

- All mechanical services above the ceiling including all cabling and associated pipework and ductwork support installations.
- All mechanical services below ground level including any underground gas pipework installed. Evidence to be taken and approved before filling in ground.
- All mechanical services to be included in voids, walls, building fabric, etc. Evidence to be taken and approved before services are covered.
- Photographic evidence of all fire damper installations. Include picture of type of cabling terminations that is being installed.
- Photographic evidence of all fire collar installations.
- Any other works deemed necessary.

## **5. ELEMENT 50 - SITE SERVICES**

### **5.1 DESCRIPTION:**

This section of the specification shall cover the following services: -

- a. Gas Services
- b. Water Services
- c. Waste Services

The mechanical contractor must coordinate with the main contractor regarding the location of all required trenching and OPES required to complete the installation.

### **5.2 MAINS WATER:**

This Specialist shall supply and fit approved stopcocks, with ground box and heavy duty covers, on the rising mains. This Specialist shall include for pressure testing.

The Mechanical Contractor will be required to obtain an analysis of mains water taken from the site supply point. This shall be checked with the local water authority or a water treatment specialist to ensure analysis results are typical for the site area and report abnormalities. The contractor is to allow in the tender for water softening measures to be installed, in case the analysis results are non-satisfactory.

### **5.3 BUILDER'S WORK:**

The mechanical contractor must coordinate with the main contractor regarding the location of all required trenching and OPES required to complete the installation.

### **5.4 WATER PRESSURE TEST:**

Mains are to be subjected to 7 bar for 24 hours and to be increased to 9 Bar for 1 hour in the presence of a representative of the Tipperary County Council. Testing must be carried out between suitably supported blank end pieces. Testing between 'live' shut valves will not be accepted.

### **5.5 CHLORINATION TEST:**

All mains should be swabbed and disinfected before being put into supply. The pipelines should be disinfected with water having a minimum concentration of 20mg/L of free available chlorine left in the main for a period of at least 24 hours. Chlorine residual tests shall be taken at the end of the main furthest from the point of injection. The sterilisation process shall be repeated if the chlorine residual is less than 10mg/L.

The chlorinated water must be discharged into a foul sewer never into a surface water sewer or watercourse.

## **5.6 BACTERIOLOGICAL TEST:**

After the main has been refilled, a sample of the water must be taken for Bacteriological Analysis. Great care must be taken when obtaining samples for testing and only sterile containers should be used. This sampling shall be carried out in the presence of the Engineer and / or his / her representative. A copy of the Bacteriological test report must be submitted to Tipperary County Council, Water Division.

## 6. ELEMENT 51 - HEATING CENTRE INSTALLATIONS

### 6.1 DESCRIPTION:

This Section comprises the following:

- (A) Boilers and Air to Water Heat Pumps plant and associated ancillary equipment
- (B) Heating Controls installation

The heating plant shall consist of the following:

- 2 No. 50kW Condensing Boilers
- 4 No. 24kW Air to Water Heat Pumps

The boiler plant will consist of 2 no. 50KW high-efficiency modular condensing boilers. The boilers shall be type IDEAL MAX or equal and approved. The boilers shall be supplied with a cascading kit. The heat pumps shall be Hitachi Yutaki, or equal and approved.

The boiler and heat pump suppliers shall be subcontracted to provide 3<sup>rd</sup> party commissioning of the system and provide an independent certification that the system has been installed and commissioned in accordance with their recommendations.

#### Air to Water Heat Pump

Product description

HITACHI Yutaki S 24HW or equal and approved

The air-to-water heat pump to be a highly efficient, all-in-one solution designed for both heating and cooling in residential and light commercial settings. With a wide range of rated power outputs from 4.3 kW to 24.0 kW, it caters to various space requirements—from compact homes to larger buildings. Its compact dimensions, especially in models up to 8.0 kW, allow for discreet installation, even inside a kitchen cupboard. One of the standout features of the ASHP to be its exceptional energy efficiency, boasting a coefficient of performance (COP) of up to 5.25 and achieving the highest energy rating of A+++.

This results in significantly reduced energy consumption and operational costs. Engineered to perform in extreme climates, it operates effectively in outdoor temperatures ranging from -25°C to 46°C, and can deliver water temperatures of up to 60°C even at -5°C without relying on additional electrical heating. The system should include a new intuitive wired remote control with two-zone capability and is compatible with wireless thermostats and various accessory options. Offering low noise operation, compatibility with R32 or R410A refrigerants, and available in both single and three-phase versions, the air-to-water heat pump should combine comfort, smart control, and environmental responsibility in a compact, flexible design.

Required Features

- Scroll compressor.
- Sylomer pads under compressor unit
- EVI technology
- Electronic expansion valve

- Asymmetric plate heat exchanger
- Large air heat exchanger with APS system
- Multi-stage capacity control Active cooling
- Reversible defrosting
- Enhanced defrosting with APS system
- Speed - controlled EC fan Heated drip tray - (with accessory)
- Compressor soft starter
- Phase and rotation control
- High pressure switch
- High pressure sensor - analogue
- Low pressure sensor - analogue
- Flow switch consumer - on/off - (with accessory)
- Flow sensor consumer - analogue - (with accessory)
- Plate exchanger protection
- HG-BYPASS
- Outdoor temperature sensor
- DHW temperature sensor
- Buffer temperature sensor
- Cascade control
- Modbus connection
- Solid frame structure
- Two level frame

Performance Specifications:

- Heating Capacity (A7/W35): Nominal 24 kW; maximum 32 kW
- Heating Capacity (A-7/W35): Nominal 16.5 kW; maximum 21 kW
- Heating Capacity (A-7/W45): Nominal 16.5 kW; maximum 18.5 kW
- Heating Capacity (A-7/W55): Nominal 15.5 kW; maximum 17.3 kW
- Cooling Capacity (A35/W7): Nominal 17.5 kW; maximum 20.6 kW
- Power Consumption (Heating at A7/W35): 5.59 kW
- COP (A7/W35): 4.29
- EER (A35/W7): 2.81
- SCOP (35°C/55°C): 3.6 / 2.98
- Energy Efficiency Class (35°C/55°C): A+ / A+
- Maximum Water Outlet Temperature: 60°C (down to -10°C outdoor temperature)
- Operating Temperature Range (Heating): -25°C to 25°C
- Operating Temperature Range (Cooling): 10°C to 46°C
- Refrigerant: R410A
- Backup Heater: 9 kW (3×3 kW stages)
- Water Flow Rate (min/nominal/max): 2.2 / 4.13 / 4.6 m<sup>3</sup>/h
- Minimum System Water Volume: 79 L
- Indoor Unit Dimensions (H×W×D): 890×670×370 mm
- Indoor Unit Weight: 62 kg
- Sound Pressure Level (Indoor Unit): 47 dB(A)
- Power Supply: 400 V / 3Ph / 50 Hz

### Boiler Description

Fully modulating high efficiency boiler (97%). Low Class 6 NOx emissions levels from 26mg/kWh (0% O<sub>2</sub>, dry). Premix down-firing gas burner, one-piece cast aluminium heat exchanger. Low flue gas temperature of approximately 5DegC. Built-in advanced boiler control and calorifier control fully modulating 5:1, 0-10v operation, on/off volt free enable. Quiet operation of less than 53dBA. Removable front panel, digital touchscreen control, remote signalling options.

### Buffer vessel

As part of the system a buffer vessel is required.

In order to add extra protection to the system, we are proposing a 4 port air and dirt separator for system separation. We are also proposing to use an additional magnet dirt trap to capture any residual dirt and magnetic particles.

### Air & Dirt Separation:

A combined low loss header which also incorporate the air and dirt separation. This unit is fitted with internal spirals that slows the flow rates sufficiently to release micro bubbles and absorbed air at its source, i.e., the boilers or chiller units. In addition, the internal spirals will allow all sediment and dirt to fall to the base of the header where it can be routinely flushed out of the system offering protection to the units and as the rest of the system (pumps, etc.).

Flamco XStream air and dirt separators or equal and approved should ensure lower energy consumption, less wear and tear, fewer breakdowns, a longer lifespan and thus a higher efficiency of heating and cooling installations.

## 6.2 SEALED SYSTEM:

The heat pumps shall include a circulation pump, capable of circulating water through the following equipment: the primary circuit, the Hot Water distribution pipework and the complete under floor heating circuit.

The system will be fitted with a quick fill point complete with anti-gravity loop, an expansion vessel, safety valve and pressure gauge mounted on a frame at a suitable internal location. This shall be used to periodically fill the system to make up for losses from the system and also pressurise the system.

The vessel shall comply with the requirements of BS EN 13831:2007 and shall be of sufficient capacity to accept the expansion of the water contained within the system when heated to 50°C.

The above safety valve outlet is to be plumbed to an external nuisance position, location to be agreed with engineer.

## 6.3 THERMAL BUFFER TANK BLOW OFF

Blow-offs shall terminate to the closest external wall. In the case of the house, they shall terminate towards the rear of the property approximately 300mm above finished ground level and turn in-wards towards the wall.

All blow-offs shall be piped in copper unless otherwise advised by the Engineer.

#### **6.4 TESTS:**

This Specialist shall include for pressure testing all heating, and water services pipework in accordance with the requirements of the General Specification.

## 7. ELEMENT 52 - SOILS AND WASTE

### 7.1 DESCRIPTION:

This element shall comprise the following services:

- (a) All soils and waste pipework traps etc serving toilets, kitchens and bathrooms above ground floor level.
- (b) Final waste connections to dishwashers, washing machines etc.
- (c) All WC overflows.
- (d) Cold water storage tank overflows.
- (e) This Specialist shall include for all fire collars on soils and wastes pipework where it passes through fire compartments.
- (f) This Specialist shall include for connections to builder's upstands at ground floor level and complete installation of soils and wastes as detailed on the 400 series drawings.

### 7.2 DESIGN AND AUTHORITY STANDARDS:

BS ISO 9000-2:1997	Quality management and quality assurance standards.
B.S. 4514:2001	Unplasticised PVC soil and ventilating pipes of 82.4 mm minimum mean outside diameter
B.S. 1519-1:2000	Specification for Plastics wastepipe and fittings.
B.S. 5627:1984	Specification for Plastics connectors.
B.S. 5254:1976	Specification for Polypropylene wastepipe and fittings.
BS EN 274-1:2002	Waste fittings for sanitary appliances. Requirements
BS EN14680:2006	Specification for Solvent cement.
BS EN 681-1:1996	Elastomeric seals.

All pipework and fittings to be installed in accordance with BS EN 12056:2000, Code of Practice for Sanitary pipework.

### **7.3 SOILS AND WASTE PIPEWORK**

All soil pipework shall be PVC-U adhering to B.S. 4514:2001 including all bends, branches, Boss branches and adapters. All pipework connections shall be ring seal joints allowing an expansion gap where necessary. The requirement of Marley regarding installation of ring seal joints shall be clearly and fully adhered to.

All waste pipework shall be M.U.P.V.C. waste system to B.S. 5255, 1989 including all bends, branches, Boss branches, adapters, etc. M.U.P.V.C. (modified unplasticised polyvinyl chloride). All pipework connections shall be of solvent weld system. The requirement of manufacturer shall be adhered to regarding the installation of solvent welding joints.

This Specialist shall include for all pipework fittings, cleaning doors, access points, etc. All vents from soil system shall be carried to 600mm above roof level, terminating in a suitable mushroom type cowl and bird guard. This Specialist shall provide all necessary weathering collars and aprons to the manufacturer's specification. This Specialist shall include for all pipework supports to comply with BS EN 12056:2000 the manufacturer's requirements.

This Specialist shall demonstrate to the Engineers the stability and rigidity of the entire system prior to testing.

Adequate provision for rodding and cleaning shall be provided on all pipe runs whether indicated on the drawings or not.

Pipework support shall be in zinc electro plated mild steel system.

All water storage tank overflows and W.C. overflow pipework where they discharge to atmosphere to be complete with Legionella arrestors.

### **7.4 WASTE TRAPS:**

This Specialist shall supply and install all waste traps to toilet bathroom and kitchen areas as detailed on the drawings.

All traps shall be of polypropylene manufactured to BS EN 1451-1:2000.

### **7.5 WHITE GOODS:**

This Specialist shall include for the final connection of waste services pipework to all white goods. All white goods shall be supplied and fixed in position by the contractor.

### **7.6 TESTS:**

All soils and wastes, overflows and drains shall be tested in accordance with BS EN 12056:2000. Pipework and fittings should be capable of withstanding an air test of positive pressure of at least 38mm water gauge for at least 3 minutes during which each trap should maintain a water seal of at least 25mm.

This Specialist shall provide temporary traps on each stack for the purpose of each test.

This Specialist shall supply and hand over witnessed pressure test certificates for all pipework tests.

The storage of P.V.C. pipework shall be in accordance with the manufacturer's requirements.

## **7.7 FIRE COLLARS:**

This Specialist shall include for the supply and installation of all fire collars on all soils and wastes pipework 50mm diameter and above where they pass from fire compartment to fire compartment on horizontal and vertical runs.

All fire collars shall be in accordance with BS 476-10:2009 and shall be installed strictly in accordance with the manufacturer's requirements. All collars shall be suitable for bolting and sealing to the slab.

Architects fire compartment drawings are included with the tender documents.

## **7.8 CO-ORDINATION:**

It shall be the responsibility of this Specialist to co-ordinate the installation of the soils and wastes pipework in conjunction with all other services. This Specialist shall ensure that all openings line up vertically and are fully co-ordinated with drainage from manholes etc.

## 8. ELEMENT 53 - WATER SERVICES

### 8.1 DESCRIPTION:

This section comprises the following.

- (a) Hot water services installation.
- (b) Cold water services installation.
- (c) Mains water services installation.
- (d) Cold water storage tank.

The water services installation is detailed on the 200 series drawings

### 8.2 HOT AND COLD WATER - DISTRIBUTION:

All water services pipe work, hot, cold and mains shall be of copper tube to B.S. 2871 bronze welded throughout except where exposed at sanitary fittings above floor level where a compression fitting will be acceptable.

Electric water heaters and showers are proposed for hot water generation in designated areas, as detailed in the M200 series drawings and equipment schedule.

This contractor shall include for all brackets and supports necessary to ensure the system is satisfactorily supported.

This contractor shall include for all isolating valves in the positions indicated. All isolating valves shall be gunmetal full way gate valve copper x copper to B.S. 5154/S Yorkshire or equal and prior approved.

All sanitary fittings shall be fitted with copper x copper miniball single turn isolating valves of Enkotak chromium plated finish.

All line valves as indicated on the drawings to be EN331:1998 approved.

All hot and cold-water services pipe work in the hot press shall be copper tube to IS EN 1057 2006 + A1 2010, with bronze welding or capillary fittings. The relevant clauses of the General Specification shall apply. This Contractor shall include for all brackets, supports, sleeves, fixings etc.

All pipe work passing through the structures shall appear to do so as on the angle of 90°, but where the structure is off square, the Engineers instructions shall be required. Joints in inaccessible positions shall be rejected.

At skirting level, pipe work shall be proud of walls by 25mm, clear of floor by a minimum of 100mm. 150mm clearance shall be maintained between pipe work and any part or component of the electrical installation.

In the course of installation, open ends of pipe work shall be protected from ingress of dirt, and should any pipe work be found both unprotected and unattended, This Contractor shall clean out the whole of

the pipe work with water under pressure at his own expense and until the Engineers are satisfied. Malleable iron plugs or cap sockets shall be used for protecting screwed pipe work and heavy canvas tied on tightly for welded tubing. Paper or timber plugs will not be considered adequate protection.

Pipe work, which, in the opinion of the Engineers, is misaligned, unsightly or otherwise below standards of first-class workmanship shall not be accepted.

This contractor shall ensure that all pipework is free to expand or contract over the whole temperature range.

All parts of the installation shall be so fitted that no air can be trapped.

It shall be this contractor responsibility to repair any damage to the installation.

### **8.3 COLD WATER STORAGE TANK:**

This Specialist shall include for the supply, erection and connection and testing a cold-water storage tank as indicated on the drawings. The tank shall be laid on appropriate base / platform capable of supporting the weight of the tank and the weight of the water at max capacity. The cold-water storage tanks capacity and dimensions are as follows.

Tank Capacity: 454 litre

The tank shall be of Tricel manufacture from the Aquarius range complete with NWC Format 30 finish, sealed lid, vent & overflow or equal and prior approved.

The tank shall be installed, strictly in accordance with the manufacturer's requirements.

### **8.4 COLD WATER STORAGE TANK VIBRATION INSULATION:**

This Specialist shall include for the supply and install of vibration insulation underneath the cold-water storage tank. The anti-vibration mat shall be 20mm thick and made from SBR rubber and EPDM rubber.

### **8.5 CONNECTIONS TO SANITARYWARE:**

This Specialist shall include for the final connection of water services pipework to all sanitary fixtures. All fixtures shall be supplied and fixed in position by this Specialist. See element 70 of this document.

### **8.6 CONNECTIONS TO WHITE GOODS:**

This Specialist shall include for the final connection of water services pipework to all white goods. All white goods shall be supplied and fixed in position by contractor.

## **8.7 PIPEWORK (MAINS WATER):**

All mains water services pipe work, hot, cold and mains shall be of copper tube to B.S. 2871 bronze welded throughout except where exposed at sanitary fittings above floor level where a compression fitting will be acceptable.

This contractor shall include for all brackets and supports necessary to ensure the system is satisfactorily supported.

All joints throughout to be Metal insert fittings with a copper crimp ring to ASTM F2434 – 09.

This Contractor shall include for all supports and termination box sets necessary to ensure the system is satisfactorily supported. All pipes to be laid in smooth serpentine bends.

All pipe work to be installed with the minimum number of joints and no joints located in concealed or inaccessible locations.

## **8.8 INSULATION:**

All mains water services and cold feeds shall be insulated throughout, at high level in ceiling voids, dropping in vertical ducts, in floor ducts or trenches, concealed behind furniture, within partitions, etc. Only exposed pipework at basins and WCs within the bathrooms need not be insulated.

Insulation shall comply with Technical Services Document Building Regulations providing a thermal conductivity of not greater than 0.045 W/MK and minimum thickness of pipe, outside diameter or 40mm, whichever is the lesser.

Pipework insulation shall comply with BS 5970:2012.

All pipework insulation shall be 19 mm insulated. All insulation joints both butt joints and horizontal joints shall be sealed with approved adhesive. All butt joints shall be neatly finished with all joints being sealed with approved manufacturers adhesive. Insulation shall be neatly mitred at bends, tees, valves, etc. End caps shall be installed at all valves, tees, etc.

All pipework within the hot press shall be thermally insulated.

## **8.9 IDENTIFICATION OF PIPEWORK:**

This Specialist shall include for providing identification to all water services pipework with circumferential coloured plastic tapes spaced at 2 m intervals along the entire length. The B.S. ground colour shall be indicated by two tapes on either side of the identifying tapes. All colours shall comply with B.S. 1710:1984.

## **8.10 PIPE SLEEVES:**

In all cases where pipes pass through walls, floors, duct covers or ceilings, pipe sleeves shall be provided of the same material as the pipes passing through.

These will be built in by the Main Specialist, but it will be the responsibility of this Specialist to ensure that they are built correctly.

Sleeves shall be of one length of pipe and shall project 10 mm above the finished floor level and shall be flush with the underside of the floor slab.

In walls they shall project approximately 5 mm on either side of the finished wall surface.

## **8.11 TESTS**

This Specialist shall include for pressure testing all water services pipework in whole or in part to comply with the Main Specialist. On completion of the installation, he shall demonstrate that the system is fully balanced and that correct flow rates are available at all outlet positions.

This Specialist shall carry out all necessary hydraulic and thermal tests including pressure testing the system to 5 bar and held drop tight for 8 hours.

All pressure test certificates must be witnessed and signed by the Site Mechanical Engineer or Engineer.

## 9. ELEMENT 54 - GAS SERVICES

### 9.1 DESCRIPTION OF WORKS

The works included for under this section must comprise the complete installation of piping for natural gas within the plant room.

### 9.2 PIPING

Installation, support, protection, pipework, joints and fittings must be in accordance with IS 820:2010 and IS EN 1775: 2007. Pipework inside the building, including boiler room pipework up to and including 150 mm must be un-galvanised black steel to IS EN 10255:2004, medium grade, or equivalent. Pipes over 150 mm must be un-galvanised carbon steel to IS EN 10216-1:2002 and BS EN 10217-1:2002 Grade 410 or equivalent, with wall thickness 5.4 mm up to and including 250 mm and 5.6 mm for 300 mm. For working pressures over 2 bar and up to 5 bar, buried pipes and pipes in external ducts up to and including 150 mm must be un-galvanised black steel to BS EN 10255:2004, heavy grade, or equivalent. Pipes over 150 mm must be un-galvanised carbon steel ERW to BS EN 10216-1:2002 and BS EN 10217-1:2002 Grade 360 or equivalent with wall thickness 6.3 mm up to and including 300 mm. Steel pipework must have welded joints, except where flanges are necessary for connecting to valves, equipment, etc. Fittings in steel pipework must be to IS EN 10253-1:2000 or equivalent. Flanges must be raised face slip-on boss type to BS 1560-3.2:1989 as appropriate.

Gaskets between flanges must be spiral wound metallic type with non-asbestos filling. The gas pipework within the shall be installed in accordance with IS 820:2010. Gas pipework entering the building shall conform to IS 820:2010. Proprietary systems for water sealing can be used only on approval from the Engineer.

### 9.3 GAS DETECTION SYSTEMS

The Mechanical Contractor must include for the supply and installation of solenoid valves on the gas pipework as indicated on the drawing and/or indicated in the equipment schedule. The valves must be manufactured to BS 7461: 1991 and BS EN 161: 2011.

The valve must be controlled by alarm panel and sensors as follows:

The control panels must contain relays that activate an external alarm and will operate the appropriate slam-shut valve on receipt of a signal from the sensor indicating a combustible gas presence or upon receipt of a signal from the fire alarm panel. The alarm levels must be fully programmable along the range of 0-100% LEL (lower explosive limit) of the particular gas required. The panel must be capable of running a self-diagnostic test to ensure correct function of the system. The panel must be designed and manufactured to IS EN 60079-0:2009.

In addition to the normal operation of the system, the following features must be included:

**Panic button:** Mounted on the control panel.

**Accept button:** This feature cancels the audible alarm while maintaining a standing alarm light.

**Re-set button:** When the gas concentration has dispersed, the alarm light may be cancelled by using this facility.

Full LED display to provide an accurate reading of panel function.  
Volt free relays to allow for the signal to Fire Alarm and BMS system.  
The panel must be capable of correction for sensor drift via its span and zero potentiometers to maintain a true gas reading.  
The sensor(s) must be the poison-resistant pellistor type, complete with stainless steel housing to EEXed IIC T6 standards (minimum). The sensor(s) must be capable of re-calibration to correct for drift and must be calibrated to suit the particular gas required.

## **9.4 PAINTING**

After erection and testing have been completed and passed by the Engineers all uncovered piping, and brackets must be thoroughly cleaned, scraped, and left smooth for painting. All Gas pipework to be painted in accordance with GNI regulations.

## **9.5 CONNECTION TO EQUIPMENT**

The Mechanical Contractor must include for connecting up to all appliances & equipment. The contractor shall include for the installation of gas pressure regulators on connection to each item of equipment, including each boiler, hot water generator.

## **9.6 TESTING**

After the erection is completed the whole of the piping, valves and fittings must be tested in accordance with relevant Section Inspection Testing & Commissioning of this Specification.

## 10. ELEMENT 56 - SPACE HEATING SERVICES

### 10.1 DESCRIPTION:

This element comprises the following:

- (a) Installation of Underfloor Heating

### 10.2 PIPEWORK AND FITTINGS:

All heating pipework shall be copper tube to IS EN 1057:2006 + A1 2010. All heating pipe work shall be copper tube to IS EN 1057:2006 + A1 2010, with bronze welding or capillary fittings. The relevant clauses of the General Specification shall apply. This Contractor shall include for all brackets, supports, sleeves, fixings etc.

All joints throughout to be Metal insert fittings with a copper crimp ring to ASTM F2434 – 09.

This Contractor shall include for all supports and termination box sets necessary to ensure the system is satisfactorily supported. All pipes to be laid in smooth serpentine bends.

All pipe work to be installed with the minimum number of joints and no joints located in concealed or inaccessible locations.

Pipe work shall be new, clean, and free from defects, of even bore throughout and shall be delivered to site and stored, with the manufacturer's protective coating undamaged.

Each of these systems shall be treated with Fernox MB-1 inhibitor. The inhibitor shall be injected directly into the system and a concentration of 4% is recommended.

Each system shall be flushed thoroughly in accordance with BS 7593: 2006, prior to introduction of the inhibitor.

### 10.3 SUPPORTS AND BRACKETS:

This Specialist shall include for the supply and installation of all necessary supports and brackets, on all heating pipework, carried exposed at low level, exposed at high level and behind furniture. Support and bracket details and types must be prior agreed with the Engineers prior to installation. Brackets shall be spaced in accordance with the requirements of the General Specification. Due allowance for movement and expansion must be made.

### 10.4 TESTING:

This Specialist shall include for pressure testing, to twice the working pressure for the entire heating distribution pipework systems, with all radiators disconnected, and connections blanked off. The pressure test must be held, without loss of pressure for 4 hours, and must be witnessed by the Engineer.

This Specialist shall include for full balancing of the system to ensure correct flow rates and thermal outputs. He shall demonstrate to the Engineers satisfaction that the systems are in full thermal balance.

**Once the system has been demonstrated to and accepted by the Engineer, it is the responsibility of this Specialist to ensure the mains water temporary connection is disconnected.**

## 10.5 VENTS:

This Specialist shall include for the supply and installation of automatic air vents at the high points of all heating distribution pipework systems, whether shown on the drawings, or otherwise.

## 10.6 INSULATION:

All heating pipework, exposed at high level, concealed in ceiling voids or floor voids, and carried behind furniture and fittings, must be fully insulated as per building regulations Part L: 2011.

Insulation shall comprise polyethylene foam insulation with all joints sealed by this Specialist. Pipework insulation shall comply with BS 5970:2012. Insulation thickness shall be as follows:

(a)	Pipework up to 25 mm diameter	-	19 mm thick.
(b)	Pipework from 25 mm to 40 mm diameter	-	25 mm thick
(c)	Pipework in excess of 40 mm diameter	-	32 mm thick

All pipework within the hot press shall be thermally insulated.

## 10.7 FLOOR AND WALL PLATES:

This Specialist shall supply, and fit chromium plated, clip on, floor and wall plates where heating pipework passes through floors and walls, where exposed only.

Plates shall be full size, and pipework shall be arranged and laid out, to suit full size plates.

## 10.8 SLEEVES:

Where pipework passes through walls or floors, it shall be sleeved with metal sleeves, supplied by this Specialist, but built in by the Main Specialist.

Sleeves shall finish flush with the finished works or floor surface and shall be sized to allow free movement of the pipe. This Specialist shall be responsible for the correct and accurate building in of all sleeves.

## 10.9 UNDERFLOOR HEATING:

This specialist shall supply and install under floor heating as indicatively shown on the drawings. The mechanical contractor specialist shall be solely responsible for the design, installation, and commissioning of the entire under floor heating system. The specialist supplier shall be Polytherm or equal approved.

Control shall be via an individual time and temperature digital touch screen thermostats with one provided per underfloor heating zone., located in each area served. A single stat per floor/controlling multiple rooms off one stat shall not be acceptable.

Each underfloor manifold shall have a 3-port analogue mixing valve mounted on the flow header, which shall control the outgoing temperature to the underfloor heating system. A maximum flow temperature of 45°C shall not be exceeded at any time.

The max floor surface temperature shall not exceed 29°C in an occupied zone as per BS EN 1264-2:2008 (E). The max floor surface temperature shall not exceed 33°C in an unoccupied zone as per BS EN 1264-2:2008 (E).

The cost of relocation, resurfacing or replacing the floor and pipe work if not installed correctly shall be solely borne by the mechanical contractor.

This specialist shall agree the final locations of all under floor heating, on site, with the Engineers, prior to ordering and shall check the spaces available to ensure the system and manifolds can be accommodated. He shall adjust dimensions to suit. He shall then submit a detailed drawing of the under-floor system, with dimensions and outputs, to the Engineers for approval. **It should be noted that the some of the floor are timber joists construction and a specialist installation matt is required, supplied by Polytherm or equal approved.**

#### **UNDER FLOOR HEATING INSTALLATION:**

This specialist shall install all under floor heating insulation as follows: -

##### **Pipework details:**

The underfloor heating pipe should be Polytherm or equal approved (PE-RT/AL/PE-RT) and comprised of raised temperature polyethylene PE-RT with overlapped aluminium oxygen diffusion barrier and an outer tube of raised temperature polyethylene PE-RT layer giving a nominal outside diameter of 16mm and a nominal wall thickness of 2mm.

- KIWA Certified pipework according to EN 15875
- Manufactured in accordance with DIN 16892/93 & DIN 4726
- Operational range – 90°C max @ 6 bar, constant temperature 70°C, max peak 100°C
- 50-year service life – 10-year insurance backed warranty
- There shall be no joints allowed under the floors.
- The pipe shall be laid on EPS INSULATION and polyethylene plastic sheeting.
- The pipes shall enter and exit the manifold into the slab protected by pipe bend fixtures.

The floor heating pipe shall be installed onto self-adhesive track rails secured to insulation laid at 1m centres across the floor. Cutting of pipe should be done by secateurs only.

##### **Manifold details:**

All manifolds and room thermostats indicated on the drawings.

The manifold consists of 2 bars for flow and return lines and made of high quality annealed austenitic and corrosion resistant stainless steel. The primary connection will include mounted ball valves removable and screw connection plugs.

Each take off connection point on the flow bar must be equipped with an integrated volume flow control valve (0 – 3 l/min) including a gauge – glass and shut off function. Each manifold bar shall have pre-assembled horizontal bleed/drain valve at the bar end.

The Contractor shall include for the following as part of the installation.

- All Flow and Return pipework to the Manifolds.
- All Manifolds as shown on Mechanical Services Layout Drawing.
- Joule Underfloor Pipework (oxygen barrier certification required).
- 16mm Conduit for Pipe Work.
- 90 Degree Bend Supports.
- Pipe protective jackets for expansion.

The Contractor shall include for all necessary testing and commissioning of the system.

### **Installer Instructions:**

#### **SURFACE PREPARATION**

The floor must be level within a tolerance of no more than +/- 6mm on a three-metre straight edge. The floor shall be swept clean of dust and debris before laying the pipe loops.

#### **EDGE INSULATION**

Edge Strip Insulation with back adhesive, is to be used on both sides of ALL internal walls and on internal sides of ALL external walls to allow the concrete screed to expand at least 5/10mm prevent cold bridging (By Main Contractor). All strips that are jointed to have 25mm overlaps minimum.

### **Notes:**

Maximum length of loop to be no more than 100m.

Crossing of pipes to be avoided always.

Each zone to be clearly marked and recorded for future reference so loops can be identified.

System to be purged free of air and debris upon second fix.

- Purge one loop at a time.
- Purge through the flow manifold and out the return so as not to damage the flow meters.

### **CONCRETE FLOOR EXPANSION**

A concrete floor is subject to expansions and contractions due to sudden changes in temperature. Expansion joints are required to compensate the directional changes in temperature when the surface of the screed is more than 40m<sup>2</sup> or when the length of the longest side is at least 8 metres long or when different floor coverings are used.

The Main Contractor / Builder is responsible for installing expansion zones for each Floor slab.

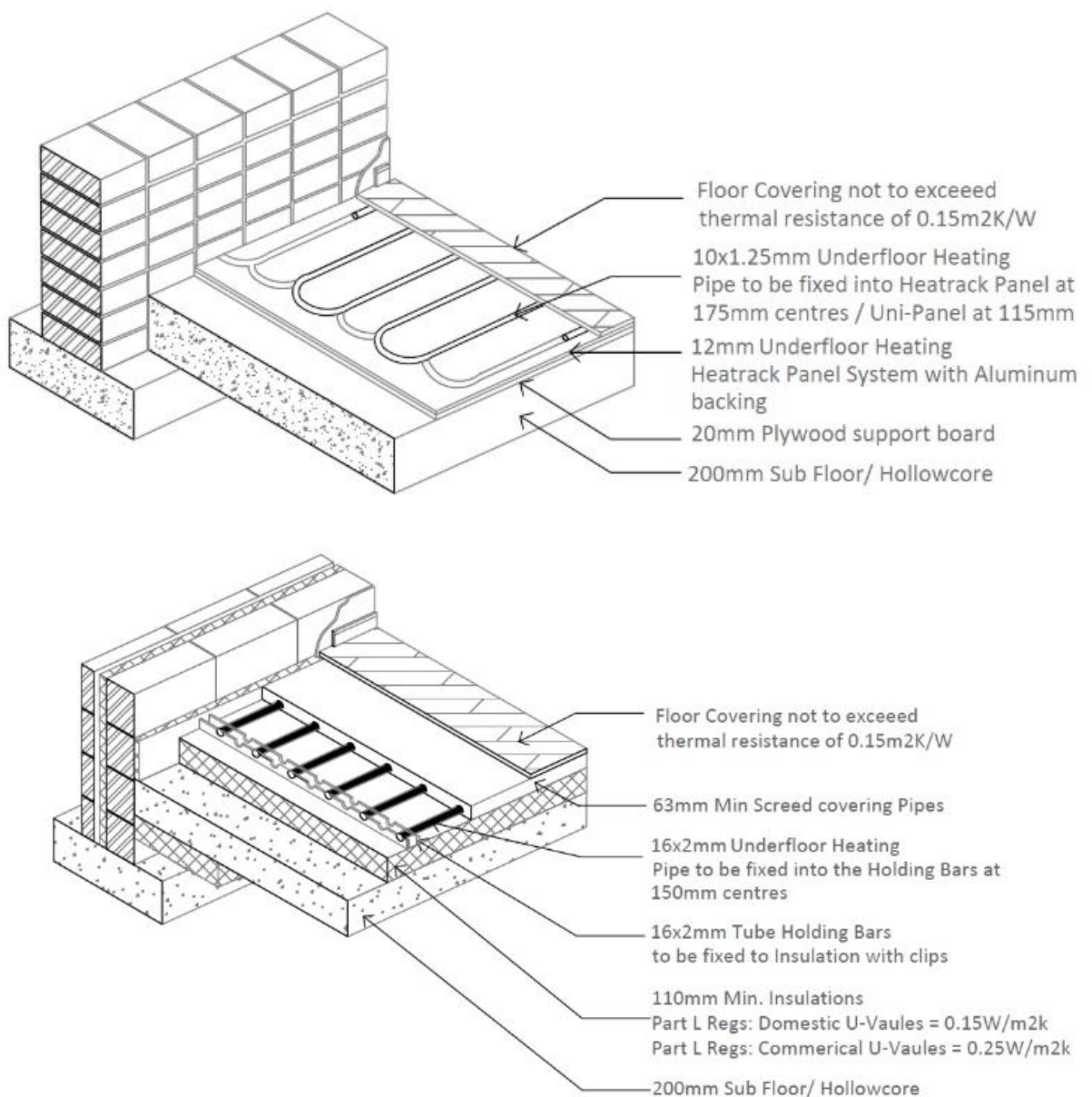
### **Testing And Commissioning details:**

The underfloor heating system shall be tested and commissioned in accordance with the requirements of IS EN 1264. Prior to laying the screed, the underfloor heating circuits shall be tested for leaks to a test pressure of twice the working pressure or 6 bar, whichever is greatest, and held drop tight at this pressure

for a duration of 1 hour. The tests shall be only considered valid if witnessed by the Engineer or Client representative and certified accordingly. The test pressure shall be maintained during the laying of the screed. Initial heating up shall be carried out within 21 days of laying the screed, or within 7 days of laying an anhydrite screed. The initial heat up shall be at a temperature between 20°C and 25°C which shall be maintained for at least 3 days. Subsequently the maximum design temperature shall be set and maintained for a further 4 days.

**Heating System Filling:**

The heating system shall be provided with a filling / topping-up point. A proprietary filling loop fitting shall be provided, comprising 2no. isolating valves, a double non-return valve, temporary (flexible) hose in accordance with the requirements of IS EN 1717. Thermal expansion of water in the system shall be facilitated by provision of an expansion vessel. The expansion vessel shall be sized in accordance with the system volume, static pressure, and max operating pressure. The pre-charged air pressure shall be adjusted by the contractor to suit the actual as-installed static pressure in the system.



**Figure 2: Typical detail of Underfloor Heating**

# 11 ELEMENT 57 - VENTILATION SERVICES

## 11.1 EXTENT OF WORKS

The works covered under this section shall comprise of the following:

- Installation of extract Air ductwork systems as indicated on the 300 series drawings.

## 11.2 DUCTWORK

### General

The following specification covers the installation of ductwork and fittings as shown on the drawings and detailed in the contract documentation. Duct sizes indicated on the drawings are clear internal dimensions and must not be altered without written request to, and approval from, the Engineer.

Ductwork materials, dampers construction and installation must comply with the relevant parts of the following publications: -

HVCA DW/144:	Specification for sheet metal ductwork - low, medium, and high pressure/velocity systems
HVCA DW/143:	A practical guide to ductwork leakage testing
HVCA DW/145:	Guide to Good Practice for the installation of Fire and Smoke Dampers
HVCA DW/154:	Specification for plastics ductwork
HVCA DW/172:	Guide to good practice for kitchen ventilation systems
HVCA DW/191:	Guide to good practice for glass fibre ductwork
HVCA TR/19:	Guide to good practice, cleanliness of ventilation systems
HVCA DW/TM2:	Internal cleanliness of new ductwork installations
BS 8313:1997	Accommodation of Building Services in Ducts

The Mechanical Contractor will be responsible for taking all measurements on site and as necessary for the fabrication and erection of ductwork.

Where site dimensions cannot be obtained in advance of shop drawing preparation, the Mechanical Contractor must make suitable provision to accommodate any discrepancies that may arise between the drawings and site dimensions.

Lengths of ducts and other constructional details must be selected to achieve maximum economy of manufacture and erection, subject to compliance with construction standards and access into buildings.

Ductwork entering the building shall be sleeved and sealed to prevent water ingress to the building. Proprietary systems can be used only on approval from the Engineer.

Ductwork must be constructed and erected to present a rigid installation free from sway, drumming and movement. Ductwork which, in the opinion of the Engineer, is misaligned, unsightly, sharp-edged, or otherwise below standards of first-class workmanship must not be accepted.

All ductwork bends, tees and any changes of direction shall be provided with multiple turning vanes to assist airflow.

Allowances must be made in ductwork construction for instrument and controls connections, and adequate local stiffening must be incorporated to provide rigid mountings.

Where ductwork is required to be internally lined, the dimensions of the ductwork must be such that the required airway cross-sectional area is maintained. Fixings must be such that lining, or insulation is maintained in contact with the duct surfaces under all operating conditions and the detachment and migration of fibres, etc. is prevented.

All ductwork located exposed or in ceiling voids above fire escape routes must be completely fire-rated.

Where ducts pass through roofs or external walls suitable weathering aprons or purpose-made arrangements must be provided to ensure weatherproof fixing.

Adequate precautions must be taken to prevent transmission of noise and vibration from ductwork to occupied spaces and structure.

As far as is practical, longitudinal seams and joints in adjacent ductwork sections must be aligned, particularly where permanently visible after installation. Perforated rivets must not be used in manufacture or erection of ductwork. The use of self-tapping screws must be restricted to the completion of site joints in extremely difficult locations only.

Where required, hand holes to permit proper joining of duct sections must be provided at the manufacturer's discretion but must be kept to a minimum and made as small as practicable. They must be rendered airtight with sealant and securely fastened.

The contractor shall include for any transitions in ducting sizes that may be required to facilitate duct crossovers while maintaining cross-sectional areas, with the full installation carried out in accordance with DW/144. These shall be identified on the contractor's coordinated services drawings.

The Mechanical Contractor must refer to the relevant section of this Specification for details of the required level of cleanliness of ductwork.

The Mechanical Contractor must refer to the relevant section of this Specification for details of pressure testing requirements. The Mechanical Contractor must ensure that metallic ductwork systems are earthed by the electrical contractor prior to insulation.

#### Galvanised Ductwork and Fittings

Materials and construction must comply with DW/144. The ductwork classification must be as indicated.

All fittings, joints, stiffeners, fastenings, sealants, gaskets, etc. must be in accordance with DW/144 and with the following: -

#### Flexible Ductwork

Flexible ductwork must be installed as indicated on the drawings, and where required between rigid ductwork and items of equipment.

Unless otherwise indicated, flexible ductwork must be constructed in aluminium. It is the responsibility of the Mechanical Contractor to ensure that flexible ductwork meets the requirements of the relevant fire authority.

The frictional resistance to air flow per unit length of flexible duct must not exceed 150% of the frictional resistance per unit length of galvanised steel duct of similar diameter.

Flexible ductwork must be kept to a minimum and must not be used between rigid sections of ductwork to change direction. Kinked or flattened ductwork will not be accepted. Sagging must be prevented by use of wire loop tie supports, as necessary. Test holes must not be formed in flexible duct.

The maximum length of each flexible duct section must be 1.0m. Connections must comply with DW/144.

Flexible ducting must comply with the air-tightness requirements for the rest of the ductwork system of which it forms part.

#### Flexible Joints

Flexible joints must be fitted at fan inlet and outlet connections, building expansion joints, and elsewhere as required. Care must be taken to maintain alignment between the fan and the duct connection.

Flexible joint material must have a fire penetration time of at least 15 minutes when tested in accordance with BS 476 and must remain flexible without strain or distortion.

Flexible joints must be kept as short as practicable above a minimum effective length of 50 mm. In no case must a flexible joint exceed 250 mm in length.

Flexible joints must comply with the air tightness requirements for the rest of the ductwork system of which it forms part.

### 11.3 HANGERS AND SUPPORTS

The supply and installation of hangers and supports must be in accordance with DW/144 and with the following:

In addition to hangers and supports required for ductwork generally, ductwork supports must be positioned close to dampers, diffusers, and all similar equipment, which must not be subjected to distortion.

Hangers for ducts that require thermal insulation must be spaced to provide clearance for the insulation.

Supports where vapour seal treatment is required must be external to the insulation.

Fire resisting ductwork must be supported with suitably sized and designed hangers which reflect the reduction in tensile strength of steel in a fire condition.

All sharp edges and cut ends must be suitably protected. Threaded rods supporting hanger brackets must be trimmed off in accordance with Health and Safety Regulations.

### 11.4 ACCESS OPENINGS

Access openings and inspection covers for the inspection, cleaning and servicing of plant and equipment must be provided in accordance with DW/144. Access openings and clean out doors for the internal cleaning of ductwork must be provided in accordance with the requirements of HVCA TR/19.

Openings shall be provided on the ductwork systems at all locations as per Table 2 of TR/19 and be sized in accordance with Table 1 of TR/19. Notwithstanding the requirements of TR/19, access openings should at a minimum be located at every bend, change in direction, every 10m on horizontal ductwork distribution,

at high, medium and low level on vertical risers and at either side of fire dampers, fire-smoke dampers, volume control dampers, constant volume boxes, attenuators, filters on the ductwork systems. Access openings for cleaning and inspection purposes shall be proprietary insulated type, factory cut with smooth seamed finishes without any coarse or sharp edges. On site cutting for access shall not be permitted. All ducting access requirements shall be indicated on the contractor's coordinated services drawings, which are required to be presented to the Engineers six weeks in advance of the services installation works commencing.

The Mechanical Contractor must ensure that access openings are not obstructed by pipework, cable trays or any other obstacle and that they are fully accessible for future use. Where practical, openings must be arranged so that they are accessible from circulation areas to minimise disruption in occupied rooms.

## 11.5 TEST HOLES

Test holes for plant system commissioning must be fitted with 13mm diameter easily removable rubber or neoprene sealing plugs. Test holes must be provided in locations specified in DW/144 and also in all branch ducts.

## 11.6 CONNECTIONS TO BUILDER'S WORK

Connections to builder's work must be as detailed in DW/144.

## 11.7 PROTECTIVE FINISHES

Protective finishes must be as detailed in DW/144.

## 11.8 DAMPERS

### General

The general constructional requirements of dampers must be in accordance with DW/144. The respective functions and types must be as indicated. Damper frames and blades must be constructed to ensure rigidity and prevent distortion and jamming in operation. The blades must be securely fixed to the operating spindles so that differential movement cannot occur.

Manually and automatically operated dampers must include a means for indicating externally the position of the blades. Manual dampers must include a device for positioning and locking the damper blades. Ratchet and pawl locking devices are not acceptable.

Air leakage through dampers when in the closed position must not exceed 5% of the maximum design air volume flow rate at the maximum design air total pressure.

All dampers must be positioned in easily accessible locations. Dampers beyond reasonable access by ladder, etc. must be provided with substantial sheathed flexible operating gear extended to normal working height.

Dampers must be installed in accordance with relevant Standards, Building Regulations and Local Authority requirements as well as the manufacturer's recommendations.

### Regulating Dampers/Motorised Dampers

Unless otherwise indicated, regulating dampers must be multi-leaf, opposed blade type. The blades must be adjustable through a nominal 90° angle simultaneously being interconnected linkage or gears, connected to a quadrant or similar operating mechanism. Where automatic control of the damper is required, maximum width must be 1200mm and a spindle must be extended to enable a powered actuator to be mounted. The actuator must be securely fixed to damper frame and spindle. Automatic control dampers for natural ventilation application must be ultra-low leakage to DIN 1946 Part 4 and double skin insulated for energy saving. Bearings requiring lubrication must be accessible.

All balancing dampers must have a locking device located on the outside of the case and must give clear indication of the actual blade position. The position of all dampers, as set after final regulation, must be permanently marked at the adjusting device.

Unless otherwise indicated, balancing dampers must be provided in the following locations: -

- In each branch from a main or sub-main.
- At all plant discharges.
- On individual branches to all grilles and diffusers. Dampers must be located as far from the grille or diffuser as practicable.

### Non-Return Dampers

Non-return dampers must be of the motorised type and must be arranged to close on detection of failure of airflow, except those for small, packaged twin-fan extract units.

### Attenuation

Provide each CVB with Attenuator to reduce air-regenerated noise for supply or extract air, casing with acoustic lining, suitable for air velocities up to approx. 20 m/s, circular spigot to fit controller, rectangular connection suitable for attachment of duct flanges, casing leakage meets class A, DIN EN 1751, meets cleanliness requirements class 3, VDI 2083 and class 100 to US Standard 209 b with respect to particle limits.

Materials:

Casing in galvanised sheet steel, lining in attenuator mineral wool, in inlet area with glass fibre facing, otherwise glass fibre matting suitable for air velocities up to approx. 20 m/s, non-flammable in accordance with DIN 4102, material class A2.

### Fire Smoke Dampers

All fire dampers must be CE marked. A copy of the EC certificate of conformity as per EN 15650:2010 must be submitted to the engineers before installation for inspection and approval.

Unless otherwise indicated, fire dampers used singly or in combination shall have achieved a fire resistance of EI 120 (ve-ho) S when tested in accordance with EN1366-2: 1999 by a New Approach Notified and Designated Organisation (NANDO). In all cases, evidence of fire rating in accordance with IS EN 1366-2: 2000 and/or ISO 10294-1 shall be provided.

Fire dampers suitable for installation in the vertical orientation must carry the letters “ve” as part of their classification, while dampers suitable for installation in the horizontal orientation must carry the “ho” indicating that the dampers have been tested to EN 1366-2:1999 in the orientation in which they are to be installed.

The fire damper casing shall comply with the tightness requirement for EN 1751:1999 class C.

The fire resistance of all dampers must match or exceed the minimum requirements set out in Technical Guidance Document B, Building Regulations.

Unless otherwise indicated, each fire damper shall be held in the open position by a corrosion-resistant retaining device incorporating a replaceable fusible element. Unless otherwise indicated, the fusible element shall operate at a temperature of 72°C.

Fire dampers shall be of proprietary manufacture and constructed from either a corrosion-resistant material such as stainless steel or be galvanised or otherwise treated to minimise corrosion. The dampers shall be housed in a rigid framed, corrosion-resistant casing which shall not distort under fire conditions.

Each fire damper casing shall be clearly marked with a permanent indication of the correct fixing attitude of the damper, the direction of air flow and the side at which access or maintenance openings shall be located.

Fire dampers shall be located in such a position and be of a type that facilitates periodic manual release and re-setting for test purposes.

The Contractor shall ensure that fire dampers comply with local fire authority requirements.

Fire dampers shall be installed so that they maintain their integrity against the passage of fire for the required period of fire resistance.

Fire dampers shall be adequately fixed into or to the construction being protected.

Where fire dampers are to be installed in partition walls, supports shall be independent of partitions and installed in strict accordance with manufactures guidelines. Fire dampers which are supported only by the ductwork in which they are located, or by timber battens, frames or other methods that do not provide the fire resistance required, are not acceptable.

The installation detail for the dampers shall be suitable for concrete, masonry walls, or lightweight plasterboard walls, floors and ceilings. In order to facilitate efficient installation and eliminate possible errors, only one damper installation detail is acceptable for concrete walls, lightweight walls, ceiling and floors.

Fire dampers provided in fire-resisting ceilings shall be adequately supported either by the ceiling or from the structural soffit. It is not acceptable to form an opening, install a diffuser or grille, and fit a fire damper above, if the gap between the ceiling opening and the fire damper does not achieve the required fire resistance.

Dampers shall be ready for installation as delivered with no additional frames required. Dampers that permit smoke leakage through the expansion or installation frames from one side of the wall or floor to the other will not be acceptable. The Contractor shall provide details of fixings and supports to the Engineer for approval.

Intumescent fire dampers shall only be used where indicated.

No duct lining or flexible duct shall be installed within 1.0m of a fire damper.

Fire dampers shall be fitted with a suitably sized access door to allow for maintenance and testing as detailed in Clause "Access Openings" of this section of the Specification.

Each fire damper shall be accompanied by an installation certificate which must be completed by the installer on site when the damper has been installed and fire stopped to certify correct installation of the damper. The certificates for all dampers shall be included in the project Health & Safety File.

Dampers shall be manufactured in accordance with ISO 9001 quality standard and operations of the manufacturer shall be subject to external third-party quality control.

### **Smoke/Fire Dampers**

Smoke/fire dampers shall comply with the relevant clauses of this specification for fire dampers in addition to the following. All smoke dampers shall be compatible with the BMS and allow for BMS monitoring of same.

Unless otherwise indicated, smoke/fire dampers used singly or in combination shall have achieved a fire resistance of EI 120 (ve-ho) S when tested in accordance with EN1366-2:1999 by a New Approach Notified and Designated Organisation (NANDO).

Casings and blades shall be constructed from galvanised sheet steel to IS EN 10327: 2004. Dampers shall be opposed or parallel blade operation. Damper blades shall have standard face linkage.

The relevant clauses as indicated above for fire dampers shall also apply.

Each damper assembly shall be equipped with an electric or pneumatic actuator as indicated. Where indicated, an automatic smoke/fire damper control system shall be supplied and installed as per drawing and scheduled.

## **11.9 SUPPLY/RETURN/EXTRACT GRILLES & DIFFUSERS**

The Mechanical Contractor must provide for the supply and installation of intake and extract grilles and diffusers as shown on the drawing and scheduled. The grilles and diffusers must be of mainly aluminium construction. Where steel frames are required, they must be powder coated. All grilles and diffusers must be supplied with volume control dampers and connecting collar.

All supply, return and extract diffusers and grilles shall be suitable for, and be independently fixed to the building structure, with no weight applied to any false ceiling systems.

The following section should be read in conjunction with the mechanical services schedule document with give details of project specific requirements for diffusers and grilles in addition to the general requirements identified in this specification. The following are minimum requirements.

Grilles/diffuser types must be as follows:

### **Ventilation Grilles**

Ventilation grille in rectangular construction, suitable for installation into circular or rectangular ducts, comprise front face with mitred border including counter punched holes for fixing, rear perimeter sealing strip and individually adjustable vertical and horizontal blades.

The grilles must have angled hit and miss damper incorporating airflow straightener, adjustable from the grille face, and acoustically lined plenum box.

## Disc Valves

Circular disc valves, suitable for supply and extract air, comprising valve ring with peripheral seal, central disc with threaded spindle and locknut and installation subframe with volume flow rate adjustment by rotating the central disc.

## Ceiling Diffusers

Square or rectangular construction ceiling diffusers, suitable for horizontal air discharge, consisting of diffuser face with mitred perimeter border which is counter punched for screw fixing on site and has fixed blades for horizontal discharge, border has rear sealing strip. Rear mounted opposed blade volume control damper adjustable from the front face of the diffuser. The diffusers must have angled hit and miss damper incorporating airflow straightener, adjustable from the grille face, and acoustically lined plenum box.

Refer to accompanying equipment schedules for further details.

## 11.10 FANS

### General

The Mechanical Contractor must include in his tender for the supply and installation of supply and extract fans as indicated on the drawings and as scheduled.

Values of the resistance to airflow indicated are preliminary based on the Engineer's design drawings and specified equipment. Any variations from the development of the Mechanical Contractor's co-ordination and working drawings caused by changes to equipment, components, fittings, ductwork layouts, ductwork sizes, etc. must be brought to the attention of the Engineer. The Mechanical Contractor must ensure that the fans provided are capable of delivering the required airflow when operating against the actual total system resistance considering the actual equipment installed on the ductwork system.

Fans must be constructed to proven design standards and must be capable of withstanding the pressures and stresses developed during continuous operation and during speed and duty changes. Additionally, belt-driven fans must be capable of running continuously at 10% in excess of the selected duty speed and must have a minimum of two belts.

The shaft and impeller assembly of all fans must be statically and dynamically balanced to BS 6861-2:1997.

Mechanical and electrical safety provisions and testing of fans must be in accordance with the requirements of BS 848:1997.

Vibration isolation, fan drive arrangements, electric motors and guards must be in accordance with the relevant clauses of this Specification.

The Mechanical Contractor must provide all necessary holding down bolts for fixing the equipment and must mark out and supervise the formation of all bases, curbs and weathering details as may be required and which will be constructed by others.

The Mechanical Contractor will be responsible for final tuning of fan duties on site to achieve the required air flow when operating against the actual total system resistance.

Fan types must be as follows:

### Axial Flow Fans

Impellers must be of mild steel protected against corrosion, aluminium, or moulded reinforced plastics. Blades must be of aerofoil section and, unless otherwise indicated, must be capable of pitch adjustment.

Fan casings must be rigidly constructed of mild steel or aluminium alloy and must be complete with an access door, mounting feet, anti-vibration mountings, and flanged connection spigot to take flexible connectors.

For in-duct mounted fans, the length of the fan casing must be greater than the combined length of the impeller and motor.

### **Centrifugal Fans**

Unless otherwise indicated, fans in air handling units must be belt-driven double-inlet centrifugal type with a fan total efficiency of not less than 60% and 50% for backward and forward curved types, respectively. The fan section must be tested in accordance with BS 6583:1985.

Unless otherwise indicated, centrifugal fans consuming more than 7.5kW at the fan shaft must be backward curved type with aerofoil blades, selected for operation at a fan total efficiency not less than 80%.

Where applicable, fan casings must be of mild steel sheet, with welded or riveted joints and welded angle stiffeners, constructed to permit withdrawal of the fan impeller. A plugged drain must be fitted at the lowest point in the casing.

Permanent indicators must show the direction of rotation of the impeller. Casings must have access panels with air seals to facilitate maintenance.

Impellers must be of mild steel protected against corrosion or aluminium alloy and must be of bolted, riveted, or welded construction.

### **Packaged twin fan extract units.**

Housings and cowls must be manufactured from galvanised mild steel or aluminium alloy sheets, or glass-reinforced plastics. Externally mounted units must be weatherproof. Unless otherwise indicated the fans must be arranged for automatic changeover and must be complete with back-draught dampers. Each fan must be provided with separate motors and independent drives and must be capable of delivering the full air volume specified at the stated pressure.

### **Protectively Coated Fans**

Where fans are required to handle toxic, corrosive, flammable, explosive or high temperature gases the materials of construction must be as indicated, and all relevant safety regulations must apply. Fans must meet the appropriate requirements of the above clauses. The coating must cover all parts of the complete, fan, motor and casing assembly that will be in contact with the gases. No fan must be installed if the coating has been damaged.

### **Roof extract units**

The fans used in roof extract units must meet the appropriate requirements of the above clauses. Cowls and bases must be appropriate to the location and must be of weather-resistant materials. Casings must be complete with integral weatherproofing provisions suitable for direct fixing to the building structure.

Adequate access to electrical supply terminals and lubrication points must be provided. Back-draught dampers must be provided, and fire release dampers must be fitted where required.

Electrical details of the fans must be in accordance with the Schedule of Fans. Each fan must be supplied with a starter, with overload protection and speed controllers. Fan motors must be speed variable suitable for inverter control where specified.

Schedule of Fans (refer to schedules document).

## 12 ELEMENT-58 PROTECTIVE SERVICES

### 12.1 FIRE EXTINGUISHER

Fire extinguishers shall be provided to the requirements of IS EN 3-7 and IS 291. The fire extinguishers shall be installed as shown in the fire protection drawings. The fire extinguishers shall be supplied by MSC fire or equivalent.

### 12.2 SMOKE EXTRACT

1366-8 for multi-compartment or EN 1366-9 for single compartment. Where multi-compartment ductwork is required, it must be insulated to the same period of time as the compartment through which it passes as required in DW172.

## 13 ELEMENT-59 BUILDING MANAGEMENT SYSTEM/CONTROLS

The Building Management System (BMS) supplier shall furnish and install a fully integrated building automation system, incorporating direct digital controllers (DDC) for energy management, equipment monitoring and control, suitable for the building usage. The control strategies shall be developed to ensure that the specified environmental conditions are maintained, whilst giving due regard to minimising of energy consumption.

The system design shall utilise the latest technology in “open” network architecture, distributive intelligence and processing, and direct digital control. The BMS system offered should be from the latest offerings and should be of freely programmable management and automation stations for the full spectrum of today’s building application services.

All peripheral equipment e.g. sensors, pressure switches, control valves and actuators, shall be of the same manufacture as the direct digital control modules and outstations.

The system offered shall be completely modular in structure and freely expandable at any stage from the smallest system through to large distributed systems. Each level of the system shall operate independently of the next level up.

The system shall fully be consistent with the latest industry standards, operating on Windows XP or later, allowing the user to make full use of the features provided with these operating systems. To provide maximum flexibility and to respond to changes in the building use, the system offered shall support the use of BACnet/Lon, LONworks, Profibus and Ethernet TCP/IP communication technologies. The mechanical contractor shall establish the number of equipment to be controlled / monitored by the BMS from the drawing/ schedule/ specifications. This information shall be furnished to the BMS supplier. All plant and equipment requiring control and / or monitoring functions shall be fitted with all necessary interfacing equipment readable by the BMS network.

The Mechanical contractor shall co ordinate and ensure that this equipment shall provide the required signals to the BMS. The Mechanical Contractor shall design, procure, supply, install and commission Automatic Controls to provide comprehensive automatic control systems for the proposed works. Local power supplies and all controls wiring to each item of plant shall be provided by the controls specialist.

The controls specialist shall provide all interfaces necessary for the items of plant to be controlled by the controls system. The Contractor shall employ as a Sub Contract to their Contract the Automatic Controls Specialists shall undertake all Automatic Controls and controls wiring with regard to the Mechanical Services installation.

#### **Description of required controls**

The main automatic controls shall control and interface the following main plant and equipment:

- Boilers & Air Source heat pumps for heating
- Other plant equipment's such as pumps, buffer vessel, pressurisation units...
- Gas Detection system
- Extract fans
- General Ventilation Systems
- Fire safety systems
- Metering and monitoring water, electricity and load shedding
- Renewable energy display in reception

Additional controls shall also be provided to the individual ventilation plant such as the localised extracts (refer to the appropriate schedules for further details). The Automatic Controls shall fully integrate between all plant, sensors, remote monitoring positions etc. Remote monitoring and adjustment of plant parameters shall be included within the software strategy.

The Automatic Controls shall provide necessary volt free contacts for remote packaged plant as required by the design in order that plant status and fault indication may be interfaced to the outstation. The main control panels provided under this contract shall be installed within the appropriate plant rooms.

All Electrical Services power and controls wiring shall be undertaken by the Contractor. The Automatic Controls Specialist is advised to make themselves fully aware of the site conditions and existing services. No claims will be considered due to lack of knowledge regarding the site conditions or existing installation and site conditions.

The Automatic Controls Specialist is to include for all work shown, described or apparent as being necessary for the complete and proper execution of the works. The Automatic Controls Specialist will be taken to have examined the site during the tender period and fully acquaint themselves at to the local conditions, accessibility of the site, the conditions affecting Labour and materials and the execution of the contract works generally.

#### **Scope of Works:**

- 1) Provide new manufacturers proprietary intelligent centralised controller for installation within the respective plant room c/w interconnections to all mechanical equipment.
- 2) Provision of all field power and controls wiring
- 3) Full Liaison with the Mechanical and Electrical Contractors and obtaining details of mechanical plant to ensure full compatibility with the controls provided.
- 4) All necessary final connections within the controls panel.
- 5) Preparation of wiring diagrams and as installed drawings.
- 6) Preparation of all necessary builder's work drawings' and details.
- 7) Liaison with other trades on site.
- 8) All necessary testing, calibrations and commissioning.
- 9) Conduct user training
- 10) Provision of field mounted wiring diagrams
- 11) Provide all necessary wiring diagrams and panel details.

- 12) Undertake all power and controls inter-wiring from the control panel to equipment, sensors,
- 13) Prepare necessary operating and maintenance manuals together with 'as installed' drawings complete with controls strategy/programming information, refer to Contract Preambles.
- 14) All schematics and O&M manuals shall be provided in printed format (3 copies) and USB stick. Schematics shall be provided in AutoCAD format and in DWG files. The Automatic Controls Specialist shall liaise with the Mechanical Sub-Contractor to ensure that he has a full knowledge of all electrical items to be connected to the control panel and shall allow for correctly interfacing with the same.

The Automatic Controls specialist shall ensure the following:

- 1) Circuit protection (Breaker or fuse)
- 2) Correct single or three-phase power supplies as required to all motors, prime movers etc
- 3) Correct interface with all analogue-measuring devices.
- 4) Correct interfacing with all packaged plant items including that all packaged plant is provided with volt free contacts or relays as necessary.

Automatic Controls Inclusions:

The Automatic Controls specialist shall include for the following: -

- 1) New wall mounted centralised control panel together with capability of BMS interface.
- 2) All interconnecting wiring and communication wiring between the outstation and starter sections of the panels.
- 3) Provision of controls valves where applicable.
- 4) Supply, delivery, installation where applicable, together with full commissioning of all necessary Automatic Controls. The provision of field mounted wiring diagrams together with as fixed drawings and operating and maintenance instructions. Note all wiring from panels to plant items shall be included. Power to panels shall be by others unless stated elsewhere.
- 5) Full user instruction, which shall take the form of half a day on site immediately prior to hand over of project to instruct user representatives as required with a follow up visit after 1 month of use.
- 6) Pre-commissioning of all systems including assistance to the Mechanical and Electrical Sub - Contractor in making the correct terminal connections.
- 7) Full commissioning of the Automatic Controls
- 8) Full and comprehensive commissioning reports on all control systems.
- 9) A full demonstration of every control point to the Consulting Engineer following completion of the commissioning reports.

The Automatic Controls Contractor shall provide as part of the Contractor's content and philosophy, information on the Controls proposals for the installations, this shall include the following information. The Contractor shall note that it will be in their interest that full and comprehensive information is forthcoming.

1. Overall Controls Philosophies including:
  - Control Panel Design Philosophy
  - Control Valve selections including valve authorities
  - Control Interfacing with all starters
  - Control interfacing with Packaged Plant
  - Control out station capabilities
2. Detailed Controls Performance Requirements including:
  - Safety Interfaces
  - Frost Protection
3. Automatic Controls – Control Panel
4. Existing Automatic Controls – Not Applicable
5. Commissioning Proposals
6. Wiring Diagrams including panel and external wiring diagrams, together with panel arrangement drawings

7. Containment and Trunking proposed routes in accordance with the tender drawing  
8. Full details on the hand over documentation and procedures to the advisory team and the client team, this shall include:

- Full commissioning and documented results
- Full Liaison between all Contractors
- Full Automatic Control Proving procedures to be witnessed

9. End user and Representatives instruction to include:

- Full functionality demonstration of the Automatic Controls and the Control Philosophy
- Full operation of the automatic Controls
- Setting and re-setting of the Automatic Controls
- Calibration of Controls

#### Electrical Services Wiring

The Automatic Controls Contractor shall undertake all electrical wiring works with regard to the Automatic Controls under the Mechanical Contract.

This shall include:

- 1) Works testing, delivery to site, off-loading, erecting and fixing in position, testing and
- 2) commissioning of the control panel and all outgoing wiring from the control panel
- 3) (controls and power).
- 4) Supply, install, test and commissioning of all wiring associated with the outstation.
- 5) Control and power wiring from the panel to all plant items where applicable.
- 6) Provision of controls wiring and containments to all plant.
- 7) The Mechanical Contractor shall at tender stage provide full Electrical information to enable
- 8) the Electrical Contractor to provide power wiring to the mechanical services.
- 9) All commissioning of the Automatic Controls shall be undertaken by the Automatic Controls specialist.