

SPECIFICATION & PRICING SCHEDULE

FOR

MECHANICAL SERVICES INSTALLATION

**NEW SCIENCE CLASSROOM &
TECHNICAL GRAPHICS AREA
AT HALLA LYDIA,**

**ST. DOMINIC'S COLLEGE, CABRA,
DUBLIN 7**

OUR REF: 26/009

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TENDER ISSUE

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SPECIFICATION FOR THE MECHANICAL ENGINEERING SERVICES NEW SCIENCE CLASSROOM & TECHNICAL GRAPHICS AREA, ST. DOMINIC'S COLLEGE, CABRA, DUBLIN 7

Date: 19/06/2026

Revision No.: 0

SECTION 1 INTRODUCTION

1.1 INTRODUCTION

The project consists of the complete mechanical services installation to a new Science Classroom and associated rooms at Halla Lydia, St. Dominic's College, Cabra, Dublin 7.

Mechanical services shall include new gas services, LPHW heating system, drainage services, hot & cold water distribution services, ventilation services and fire protection services.

The Mechanical Contractor shall be a domestic contractor to the main contractor.

While the detailed project requirements are described within the general technical specification and drawings, the particular specification provides a description of the services installation and draws attention to particular elements of importance.

1.2 CLIENT & DESIGN TEAM DETAILS

CONSULTING SERVICES ENGINEERS

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SECTION 2 OUTLINE OF SCOPE OF WORKS

PROPOSED SCOPE OF WORK

2.0 Mechanical Services Installation

2.1 Heating Centre (Element 51)

2.1.1 Boiler Plant

The existing boiler and burner are to be removed and a new 75KW ACV and associated works in the boiler house. Include for new flue through existing roof

2.1.2 Supply and install new gas proven and gas detection panels

2.1.3 Supply and Install new double gas taps to each workstation

2.1.4 Supply and install new pipework to zone the science labs separately from the Tech. Graphics room

2.1.5 Supply and install new 500ltr CWST and Booster pump

2.1.2 Flues - Replace all Existing Flues with new.

2.1.6 2.1.3 Heating Controls - Supply and install new pipework to zone the science rooms separately from the Tech. Graphics room.

2.1.7 Supply and install new Thermostatic rad valves onto all new radiators.

2.2 Drainage and Refuse Disposal (Element 52)

2.2.1 Sewage and waste water disposal systems.
Supply and install all new Plumbing Pipework to Toilet areas and each workbench

All above ground floor slab soils and vents will be provided under the mechanical contract. The soils and wastes will be run in PVC piping and shall include vents, cowls and anti-siphon traps as necessary. All waste water pipe work below the floor slab installed by the Main Contractor.

All science wastes shall be Vulcatine type wastes, pipework and traps.

2.3 Water Distribution (Element 53)

2.3.1 Storage and Distribution of Cold Water.

2.3.1.1 Cold water to be extended from existing supply.

2.3.1.2 Cold water supplies will be provided to all wash hand basins and wc's.
All cold water termination points are to be prepared and blanked in preparation for the subsequent fitting of cold water taps.

2.3.1.3 All cold water distribution pipe work located in the attic space and above ceilings shall be properly insulated. The insulation shall consist of sections of rigid mineral wool incorporating aluminium foil cover.

2.3.2 Drinking Water (Mains).

Note: All external water services to the boiler house including connection to council mains and fire hydrant installation will be the responsibility of the Structural Engineer and installed by the main contractor.

2.3.2.1 The mains water supply to the building shall be valved in the boiler house and distributed within the school to the cold water storage tanks and stainless steel sinks.

2.3.2.3 1 no. external tap will also be provided under the mechanical services contract.

2.3.2.4 All mains water service pipe work shall be run in non-metallic pipework to engineer's approval. During the course of the installation timber or metal plugs shall be used on pipe ends to prevent the ingress of dirt.

All mains water termination points are to be prepared and blanked in preparation for the subsequent fitting of taps.

2.3.2.5 All mains water distribution pipe work located in the attic space and voids and boiler house shall be properly insulated. The insulation shall consist of sections of rigid mineral wool incorporating aluminium foil cover.

2.3.3. Hot Water

- 2.3.3.1 All hot water service pipe work shall be run in light gauge copper to BS 2871 Part 1 Table Y. During the course of the installation timber of metal plugs shall be used on pipe ends to prevent the ingress of dirt.

All hot water termination points are to be prepared and blanked in preparation for the subsequent fitting of hot water taps.

- 2.3.3.2. All hot water distribution pipe work shall be properly insulated. The insulation shall consist of sections of rigid mineral wool incorporating aluminium foil cover.

- 2.3.3.3 Undersink Water Heaters shall be provided.

2.4 Gas Supply Services (Element 54)

Existing Gas supply to be modified to service the new Boiler and the new science rooms.

2.5 Space Heating (Element 56)

2.5.1. Central Installation (Heating System)

This section includes the provision of an L.P.H.W. heating system supplied via 2 no. flow and return headers via existing oil boiler. The heating system via medium grade black M.S. tube pipework and steel panel type radiators and radiant panels. Radiators to be minimum 1.5mm thickness.

See enquiry drawings

- 2.5.1.1 L.P.H.W. pipe work shall be run in a black mild steel to BS 1387 medium with fittings of similar gauge to BS 1965 seamless with butt welded joints.
- 2.5.1.2 All heating pipe work located within the boiler house and above in attic space shall be suitably insulated with sections of rigid mineral wool incorporating aluminium foil cover.

2.5.2 Local Appliances

2.5.2.1 Radiators and Radiant Panels

Steel panel type radiators of the type and size shown on the schedule and detailed on the drawings shall be supplied and erected in the locations specified and installed in accordance with the manufactures instructions. All radiators to have minimum 1.5mm thickness.

2.5.3 Control Systems

- 2.5.3.1 Motorised 2 port diverting control valves shall be provided to each room and shall be effected by room thermostat.
- 2.5.3.2 Control valves shall be fitted on the flow and return connections to all radiators.

2.6. **Ventilation (Element 57)**

2.6.1 Central and Local Installation.

- 2.6.1.1 Mechanical ventilation will be provided to the fume cupboards and preparation room. Ductwork for same will be terminated through the external wall with suitable grill fitted.
- 2.6.1.2 Mechanical Extract Fans, ductwork and dampers shall be located as per the enquiry drawing.

2.7 **Other Services (Element 58)**

Fire Protection Services

2.7.1 Extinguishers & Blankets

- 2.7.1.1 Fire extinguishers are to be provided as shown on the proposal drawings.
- 2.7.1.2 Fire blankets are to be provided as shown on the proposal drawings.

2.7.2 External Fire Fighting Services

Note: All external fire fighting services will be the responsibility of the Structural Engineer and installed by the main contractor.

SECTION 3 CONTRACTUAL INFORMATION

N/A

REFER TO MAIN CONTRACT PRELIMINARIES DOCUMENT.

SECTION 4 SCOPE OF WORK & PROJECT PARTICULARS

Services (Mainly Piped and Ducted)

This section includes the provision of a Low Pressure Hot Water (L.P.H.W.) heating system to new building detailed in the drawings and specifications. The entire installation to be affected by the existing oil fired system.

4.1 Heating Centre (Element 51)

4.1.1. Boiler Plant

New plant As per Section 2.

TWIN BOILER THERMOSTAT

New plant As per Section 2.

4.1.1.3 PRESSURE VESSEL AND PANEL

New plant As per Section 2.

4.1.1.4 Boiler House Pipework, Valves, heating circulation pumps

The mechanical contractor shall allow for a new heating circuits in the existing boiler house for the new science rooms and separately for the new Tech. Graphics room. Circuit to include MS pipework, valves, 3 port motorised valve and Grundfos pump to match existing.

4.1.1.6 Supply and Return Headers

New headers to be provided to facilitate new circuits

4.1.1.7 Insulation to Boiler house pipework

All pipework in the boiler house to be fully insulated by the Mechanical Contractor. Shall be Crown, density 80 kg/m³ with metal cladding or equal to approval.

4.1.2 Control Systems

4.1.2.1 BOILER HOUSE CONTROLS

The existing boiler house controls are to be extended to facilitate the additional new heating circuits

The control system shall comprise of self-learning optimum start/ stop control, flow temperature compensation based on internal, external temperature, motorised valved zone control, maximum internal and external temperature automatic cut out and automatic frost protection.

The controls shall include a manual override with run on timer so that heating is available for occasional out of hours use. This shall be located within the electrical store. This unit shall be of a type appropriate for its location in terms of aesthetics and size. Industrial type housing shall not be acceptable.

Holiday switching shall also be provided on the heating centre plant room control panel.

The positioning of circuit / zone sensors are located as per the enquiry drawings.

The heating centre plant room control panel shall incorporate a BMS outstation. Holiday switching shall also be provided on the heating centre plant room control panel.

All wording on the control panels shall be agreed with the Engineer beforehand. The actual zones shall be defined on a colour coded A3 drawing, which is to be laminated, framed and fixed on, or immediately adjacent to the panel on a timber backing screwed to the wall. No abbreviations are to be used on the panels without an explanation in full provided on the drawing.

Two-stage frost protection shall be provided and be so arranged as to activate the circulating pumps at internal temperatures below 5 °C and fire the boiler burners when system return temperature drops to 2°C. The frost protection system shall be independent of optimum start controllers.

Weather compensation shall be provided on the boiler house controls.

Boiler Control Panel (located in the boiler house)

- Boiler Unit
 - Shunt Pump
 - Heating Circulation pumps
 - 4 no. 3 Port Motorised diverting valves in boiler house.
 - Time clock control 7 day 24 hour (including automatic water / Summer time change)
 - Room Thermostats
 - Frost Thermostat
 - Heat Dissipation Thermostat
 - Holiday switch (to allow for the non-operation of the heating system but to maintain frost protection
- Remote panel (located in new science block)
- Controls to operate
 - (i) 1 no. heating circuits
 - (ii) 1 no. hot water circuit.
 - Holiday / Override

The Contractor must allow for the installation of all equipment associated with the control system. All items of equipment to be wired by the electrical specialist contractor shall be handed over and as well as all explanatory literature.

Points list and schematics as per the enquiry drawings.

Existing Controls by InTouch Controls.

4.1.3 Testing and Commissioning

4.1.3.1 Commissioning of Boiler and Burner

The Contractor shall arrange with the suppliers of the boiler / burner units or its manufacturers to have them re-commissioned and to obtain from them a certificate that the burner had been set to the correct air adjustment. The certificate received should be forwarded to the Engineer responsible for the job and marked for his attention.

The Contractor is to arrange with the manufacturers for an inspection of the burners within one month after the date of re-commissioning to ensure that all necessary adjustments for the satisfactory and efficient running of the burner are made

The heating system shall be flushed and provided with appropriate chemical treatment. A commissioning certificate confirming that the correct treatment has been applied will be required prior to handover.

COMMISSIONING OF INSTALLATION

The Contractor is to be present when the system is being put into commission and will be responsible for balancing the various circuits. He shall give full instruction to the School Authorities regarding the operation of the heating and oil

burning equipment and shall hand over to them all the printed instructions pertaining to the operations and maintenance of the plant, which are supplied by the manufacturers with the equipment. The Contractor is to hand over to the School Manager three radiator vent keys and three keys to operate all lock-shield valves.

4.2 Drainage and Refuse Disposal (Element 52)

This section comprises the supply, installation and testing of all soils and wastes above ground from sanitary fittings in toilet areas and kitchens in accordance with EN ISO56-2:2000. All pipework and fittings from WC's shall be as manufactured by Messrs. Wavin Ltd., Marley Ltd., Qualplastic Ltd., or equivalent.

All wastes, pipework and traps within the science room and preparation room shall be Vulcatine pipework throughout.

Below ground wastes up to and including their termination as ground sockets is described within the Civil Engineering Specification and does not form part of the Mechanical Services works.

The Contractor shall be responsible for installing all above ground soils and waste drainage pipework and fittings in accordance with EN 12056-2:2000.

The Contractor shall install the complete above ground soils and wastes installation including associated vent and overflow pipe work.

All SVP's (Soil and Vent Pipes) shall be uPVC with all branch pipes manufactured from polypropylene.

The supply, installation and fixing of sanitary ware is by others.

The system shall be installed using the minimum pipe work lengths and minimum number of fittings necessary to carry away all discharge from sanitary appliances and provide adequate access for cleaning purposes.

The Contractor shall include for:

- Provision and installation of all traps
- Final connections to all sanitary ware
- Fitting of all over flow pipe work required
- Fitting cowls to all SVP's where they terminate above roof level
- Fitting traps and insect screens to all overflows

Air admittance valves shall not be used except by express permission of the Employer's Representative.

4.2.2.1

Waste Pipes

All waste pipes from sink units and WHB's shall be rigid PVC

pipework, or similar to approval. Care shall be taken on site to ensure that this pipework is stored under cover, and under no circumstances may the contractor store this pipework externally.

Waste Stack Connections

All PVC/PVC pipework connection shall be of rubber ring socket type.

The pipe end to be inserted in the socket shall be cut square using a fine tooth saw, and all swarf shall be removed with glass paper. The cut ends of the pipe and the socket into which it will be inserted shall be cleaned and coated with the manufacturers approved adhesive. The pipe end shall then be pressed fully home and the joint inspected for any faults.

Bend on Waste Pipes

The contractor shall supply and install PVC sweep type bends from WHBs and sink units in the positions shown on the drawings.

Pipe Supports

All pipework shall be supported at 600 mm centres. Pipes shall be secured to the walls with a screw-on type bracket using rawl plugs and wood screws.

Connections to Wash Hand Basin

The Contractor shall provide a blanked up stand 1200mm high (as detailed) suitably finished to allow for future connection of the wash hand basins and sinks.

Please note: The final connection and installation of sanitary fittings, associated taps and drains will be completed by others.

W.C. Connections

The contractor shall provide 400 mm long blanked over length of soil pipe (as detailed) prepared finished to allow future connection to WC's. The WC's locations are as per drawings. All WC's are to be gravity feed from the CWS Storage Tanks.

Please note: The final connection and installation of sanitary fittings will be completed by others.

Access Points

The mechanical services specialist shall be responsible for including for all access points required to safely clean and

maintain the complete soils and wastes installation. Access points shall include access doors above flood level at each floor in all S.V.Ps.

Overflows

WCs shall be provided by the contractor with internal siphon overflow protection which shall prevent the use of the WC in the event of an overflow.

Tests

The Contractor shall be responsible for including all access points required to safely clean and maintain the complete soils and wastes installation without requiring destructive intrusion into the system. Access points shall include access doors above flood level at each floor in all SVP's. In the event that the Employer's Representative deems any part of the system to be provided with inadequate access for cleaning the Contractor shall fit additional cleaning doors without charge to the contract.

When the installation is complete, the contractor shall water test the pipework, and any leaks which occur shall be made good.

Faulty joints shall be remade, using new materials

4.3 Water Distribution (Element 53)

This section cover the installation of the Cold water services installation extending from the cold water storage tank to the fixtures.

4.3.1 Cold Water

4.3.1.1 Pipework

All cold water service pipework shall be run in light gauge copper to BS 2871 Part 1 Table Y. During the course of the installation timber or metal plugs shall be used on pipe ends to prevent the ingress of dirt.

Fittings

In all locations where pipework is run on the surface, jointing of the pipework shall be done using compression or capillary fittings. These shall be manufactured from copper tubing and shall be pretained ready for use. All fittings shall conform to BS 864. in locations where pipework is run underground it shall be jointed by bronze welding or by the use of capillary fittings.

Valves

All gate valves up to 50mm size in hot and cold internal water services shall have cast gunmetal bodies non rising stem with female sockets for bronze welding or alternatively have ends screwed B.S.P.T. They shall be similar to that manufactured by Messrs. Hattersley (Ormskirk Ltd) , or Crane Ltd., 65mm size shall have ends to BS 4504: Part 1 or as per particular specification.

Valves for water mains shall be of the heavy waterworks patterns and conform to the Local Authorities requirements similar to Blakeborough Ltd. Fig.3450.

Stopcocks similar to Peglers Ltd., BS. 3961:1975 shall be provided before each item of equipment listed in the sanitary schedule supplied by others.

Three keys for each size of lockshield type valves shall be supplied. All valves shall be operated in a clockwise direction.

Ballofix valves shall be provided at all connections to sanitary ware and other outlets.

Drain Cocks

All drain cocks unless otherwise specified shall be of 15mm gunmetal type similar to Hattersley Ltd. Fig. No. 81 complete with loose key and hose union. They shall be arranged at all low points and elsewhere to facilitate drainage.

Pipe Sleeves

In all places where pipes pass through solid walls or floors, suitable copper sleeves shall be provided and fitted in at such points. Sleeves shall be in one length and to be fixed flush with the surface of the finished wall or floor.

Branches to Sanitary Fittings

The contractor shall include for the making of branch connections from the cold water supplies to serve existing W.C. cisterns, wash hand basins.

All cold water termination points are to be prepared and blanked in preparation for the subsequent fitting of cold water taps.

4.3.2 Mains Water (Drinking water)

Below ground mains water pipework up to and including its entry into the building in the inside corner of the plant room shall be installed by the Main Contractor as described within the Civil Engineering Specification.

The Mechanical Services works shall include all mains water pipe work inside the building.

4.3.2.1 Pipework

All mains water service pipework shall be run in non-metallic pipework to engineer's approval. During the course of the installation timber or metal plugs shall be used on pipe ends to prevent the ingress of dirt.

Fittings

In all locations where pipework is run on the surface, jointing of the pipework shall be done using compression or capillary fittings. All fittings shall conform to BS 864. in locations where pipework is run underground it shall be jointed by bronze welding or by the use of capillary fittings.

Pipe Sleeves

In all places where pipes pass through solid walls or floors, suitable copper sleeves shall be provided and fitted in at such points. Sleeves shall be in one length and to be fixed flush with the surface of the finished wall or floor.

Branches to Sanitary Fittings

The contractor shall include for the making of branch connections from the mains water supplies to serve fresh water sinks and Water boiler.

4.3.2.2 External Taps

1 no. external taps shall also be provided under the mechanical services contract. As detailed on drawing M2.

4.3.2.3 Water Meter and Recording Equipment

A secondary water meter to be provided on incoming mains immediately after the stopcock and within the Boiler house.

4.3.3. Hot Water (Treated Water).

4.3.3.1 Pipework

All cold water service pipework shall be run in light gauge copper to BS 2871 Part 1 Table Y. During the course of the installation timber or metal plugs shall be used on pipe ends to prevent the ingress of dirt.

Fittings

In all locations where pipework is run on the surface, jointing of the pipework shall be done using compression or capillary fittings. These shall be manufactured from copper tubing and shall be pretinned ready for use. All fittings shall conform to BS 864. in locations where pipework is run underground it shall

be jointed by bronze welding or by the use of capillary fittings.

Pipe Sleeves

In all places where pipes pass through solid walls or floors, suitable copper sleeves shall be provided and fitted in at such points. Sleeves shall be in one length and to be fixed flush with the surface of the finished wall or floor.

Branches to Sanitary Fittings

The contractor shall include for the making of branch connections from the Hot water supplies to, wash hand basins and sinks.

4.3.3.2 Control Systems

All hot water termination points are to be prepared and blanked in preparation for the subsequent fitting of a tap. Rada thermotaps are to be provided by the contractor at all hot water outlets in the complete extension.

All wash hand basins shall be provided with local blending valves to prevent scalding. The connection of the hot water return pipes to hot water pipes shall be as close as possible to the final outlets and at a maximum distance of no more than 1m from the outlets.

Ballofix valves shall be provided at all final connections to sanitary ware or other fittings.

4.3.3.3 Undersink Water Heaters

The mechanical contractor shall allow for the supply and installation of undersink water heaters as per the enquiry drawings. Heaters are to be Santo Aquarius 10 litre capacity or equivalent.

4.3.4 Insulation

4.3.4.1 The surface of all hot, cold and mains water pipes and their fittings in the roof space shall be insulated with Canvas covered rigid fibreglass sections as per the manufacturer's instructions.

Insulation shall be to the following thickness:

Pipe sizes up to and including 32 mm	25 mm
Pipe sizes from 38 mm to 51 mm	38 mm
Pipe sizes from 65 mm to 75 mm	38 mm
Pipe sizes over 75 mm	50 mm

Insulation shall be Crown, density 80 kg/m³ Foilback covered, ensuring that all joints are well butted together. Longitudinal overlaps to be securely stuck down with suitable adhesive and/or taped with matching tape. Butt joints to be covered

with suitable self-adhesive tape not less than 50 mm wide, bends to be insulated with carefully mitred segments of Crown Pipe insulation covered with self-adhesive. All fittings to be insulated to the same standard and finish as adjacent pipework.

Valve jackets with Velcro fixings shall be provided on all valves within the plant room.

Within the plant room, mains, cold, hot, rain and, pressurisation, hot return, and any pipe that can potentially contain static water shall be insulated to the levels shown for external insulation. The LPWH fill tank and pressure vessel shall also be insulated with the equivalent of 100mm Rockwool insulation.

The system shall be tested, flushed, and chlorinated prior to connecting to the public mains water network. A signed certificate of testing and flushing shall be provided by the Contractor on completion of the works.

4.3.4 Testing and Commissioning

The complete installation is to be tested and commissioned as previously outlined

4.4 Gas Services

4.4.1 Extent of Work in the Section

This section covers the installation of the new gas supply pipework taken from the existing supply located in the existing Plant Room.

All overground pipework shall be run in medium steel tubes to BS 1387. Joints above 50 mm shall be welded, smaller joints shall be screwed type with approved jointing compound. All fittings shall be BS 1740.

Control valves shall be fitted at each run out to serve an appliance or group of appliances and shall be of bronze 'plug cock' type screwed to BS 21: R1977 such as 'Hattersley' Type Fig. 61 or 'Crane Type 'D300'.

4.6.2 Connections to Appliance

Final connections to appliances shall be made in thin wall copper tube. Connections between copper tube and appliance shall be by means of a copper compression to male or female adapter.

4.6.3 Tests

After installation is complete, all pipework shall be tested to 100 PSI with compressed air and shall stand for four hours with no appreciable pressure drop.

4.6.4 Colour Coding

All pipework shall be colour coded in accordance with I.C.P. 4.

4.6.5 Gas Solenoid Valve

The mechanical contractor shall allow for the supply and installation of 1 no. gas solenoid valve on the gas supply line. The valves to be 50 mm diameter, flanged gas valve, Landis and GYP type LG6F or similar complete with electro hydraulic operation.

4.6.6 Gas Detection

The mechanical contractor to allow for the supply and installation of 3 no. gas pressure proving systems, 2 no. in the new science rooms and 1 no. in the preparation room. Each system shall consist of a main panel with secondary emergency gas knock off point, solenoid valve and valve set on incoming supply.

Detection systems to be Medem or equivalent as supplied by Modern Plant Ltd.

4.6.7 Gas Cocks

The mechanical contractor to allow for the supply and installation of gas supply cocks as per the enquiry drawing. Each desktop fixed unit shall be a double outlet.

4.5. Space Heating (Element 56)

Extent of Work in this Section

This section includes the provision of an L.P.H.W.heating system which is effected by the existing oil fired boiler. New pipework and radiators shall be provided to the new rooms.

4.5.1 Central Installation Flow and Return Pipework.

4.5.1.1 Pipework and Pipe Fittings

L.P.H.W. pipework shall be run in a black mild steel to BS 1387 medium with fittings of similar gauge to BS 1965 seamless with butt welded joints.

All heating pipes shall be of best quality mild steel tube - Medium Grade in accordance with B.S. 1387:1957.

Connection, long screws or running socket pieces shall be used with smaller pipes at intervals of not more than 7 to 9m at each valve and wherever necessary to facilitate repairs probable alterations or additions. The nipples shall be stub or barrel nipples with at least 19mm of unscrewed pipe. Easy bends made by heating the pipes in a forge to correct and symmetrical sweeps without reduction of internal diameter

shall be used where feasible and suitable. Bends and elbows when used shall be of easy radius; square bends shall not be used. All bends, elbows, tees and unions shall be of good quality malleable iron or approved brand.

Proper provision and stays shall be made in the layout for expansion of pipes. Expansion joints shall only be used wherever it is found impossible to make provision for expansion by use of expansion loops.

Anchor points and stays shall be provided for controlling the movements of the mains, normal screwed joints shall be screwed with a full standard thread and made with manganese or other approved non-rusting jointing compound, the pipes being screwed home and left clean internally and externally. Flanged joints shall be made with corrugated gunmetal joint rings and jointing compound.

All exposed pipework within rooms shall be painted with a finishing paint coat to a colour selected by the Architect. All painting will be carried out by the mechanical services specialist.

4.5.1.2 Provision of Drainage and Air Vents

Subcontractor shall include for 20 mm bore gunmetal drain cocks with hose connections at all low points in the system to enable each section controlled to be drained down. Drain cocks shall be of gunmetal, key operated, Crane Fig. No. D341 or equal and approved.

Automatic air vents shall be supplied and installed on the L.P.H.W. flow and return pipework where appropriate. The air vents shall be Armstrong or Spirax Sarco manufacture or equivalent.

4.5.1.3 Unions

Unions shall be malleable cast iron, beaded type with hexagon ends and with two spherical gunmetal seats and shall be provided at all control valves with screwed ends

4.5.1.4 Run of Pipework

All pipework shall be neatly installed and grading shall be carefully carried out. All pipework shall rest properly on supports and completed installation shall present a sound engineering finish to the satisfaction of the Engineers.

4.5.1.5 Underground Heating Mains

Underground heating mains are to be copper tubing with brazed joints insulated with "Armaflex" foamed plastic pipe insulation.

13mm wall thickness sleeved uncut on the copper pipe and the butt joints joined and sealed in accordance with

manufacturer's instructions.

The outside of the "Armaflex" is to be painted with chlorinated rubber paint and covered with "Oppanol" using special fluxing agents in accordance with the manufacturer's instructions.

The joint between the underground mains and the piping in the building is to be made above floor level and the underground mains are to be hydraulically tested before the trench is backfilled.

The piping is to be laid on 50mm of fine sand in a 0.75m deep trench and covered by a further 50mm of fine sand before the trench is closed in.

The Contractor is to ensure that there is a gradual and continuous rise of 20mm per metre minimum to the higher building to prevent air locks and to ensure adequate venting.

4.5.1.6 ARRANGEMENT AND SUPPORTS TO PIPEWORK

Supports generally are to be as arranged that pipes can be readily taken down when required.

The most suitable of attachment and other accessories of approved manufacture for the several purposes shall be supplied and fixed. There shall be at least one suitable support for every 3m both horizontal and vertical. All pipework at skirting level is to be carried on vertical brackets securely fixed to the floor.

4.5.1.7 PIPES IN DUCTS

Pipes in ducts are to be free of joints where possible and if joints are necessary they are to be welded. On no account are screwed joints to be used.

Before filling in ducts the pipes are to be pressure tested as specified.

Pipes in ducts shall be covered with suitable sized "Armaflex" insulation in the unslit condition with the outside painted with chlorinated rubber paint and covered with "Oppanol" using special fluxing agents as per the manufacturer's instructions.

4.5.1.8 Isolating Valves

Isolating valves shall be provided shall be bronze solid wedge gate valves with non-rising stems, and shall conform to BS. 5154: R1977 (PN20).

Valves up to and including 50 mm $\varnothing$ shall be screwed to BS. 21: R1977 and shall be 'Crane' Model D151 'H.N.H.' Model Fig 33X.

Valves 65 mm and over shall conform to BS. 5154: R1977 (PN16) and flanged to conform to BS. 4504: Part 2: R1981. They shall be 'Crane' Model DM160 'H.N.H.' Model Fig 35

(PN16).

4.5.1.9 AUTOMATIC AIR VENTS

The contractor is to supply and install Winns Patent Automatic Air Eliminators or equivalent at the high points on all heating mains running through the roof spaces or above ceiling level. An overflow pipe is to be carried through the roof space from these to discharge outside the building. Before installation the contractor is to ensure that there is a gradual and continuous rise along these pipes to prevent air locks and to ensure adequate venting. Locations of all A.A.Vs are to be agreed with the Consultant Engineer before installation.

4.5.1.10 CIRCUIT VALVES

Circuit control valves shall be fitted where the contractor deems appropriate and shall be full-way pattern with gland surfacing boxes and iron hand wheels screwed or flanged as required with cast iron bodies gunmetal wearing parts and bronze seatings. In each flow and return circuits a "T" piece with a 25mm draw-off cock with hose connections to be provided.

4.5.1.11 DOUBLE REGULATING VALVES

Double regulating valves are to be installed on the return of each circuit within the boiler house as per the enquiry drawings. The DRV is to be 35mm bronze with positive flow control at all handwheel settings. Copper compression fittings are required. DRV to be Crane D921 or equivalent.

4.5.1.12 STRAINERS

Strainers are to be provided on the heating system as per the enquiry drawings. Strainers are to be cast iron manufacture Crane FM276 or equivalent.

4.5.1.13 FLUSHING OUT OF SYSTEM

On completion of pipework the complete system is to be chemically cleaned thoroughly flushed out with clean water, until clean water comes through. Under no circumstances is the accelerator to be installed without this work being carried out.

4.5.1.14 TESTING

The pipework and fittings shall be subjected to a hydraulic test of 100lbs per sq/inch/7 bar for a period of not less than 2 hours. During this period the system shall remain drip tight.

The Contractor is to give at least 10 days notice of when a pressure test is being carried out so as to allow time for the Engineer or his representative to arrange to be present and witness the test.

4.5.1.15 Commissioning

The complete installation is to be tested and commissioned as previously outlined

4.5.2 Local Appliances

4.5.2.1 Radiators and Radiant Panels

Steel panel type radiators manufactured by Korado, Veba or Runtal or equivalent of the type and size shown on the schedule and detailed on the drawings shall be supplied and erected in the locations specified. Radiators shall be mounted so as to leave a space of 150 mm between the bottom of the radiators and the finished floor. Radiators shall be rigidly supported on steel brackets supplied by the radiator manufacturers. A clear space of at least 40 mm shall be left between the back of the radiator and the wall. **All radiators to have a minimum wall thickness of 1.5mm.**

4.5.2.2 Taking Down of Radiators

The contractors to include in his tender for the taking down of the radiators **twice only** after the initial erection to allow for other building finishes.

4.5.3 Control Systems

4.5.3.1 2 & 3 Port Motorised Diverting Valves

Danfoss H-Series Motorised 2 & 3-port diverter valves or equivalent shall be provided where shown on the drawings.

4.5.3.2 Radiator Control Valves

Control valves shall be fitted on the flow and return connections to all radiators. The valves on the flow shall be of the handwheel pattern with composition handwheels, while those on the return shall be of the lock-shield pattern. Where exposed valves shall be of the easy clean type with chromium-plated finish. Valves shall be gunmetal throughout and shall be of angle or straight pattern to suit connections. Valves generally shall be complete with gunmetal unions fitted on the heater side so as to allow disconnection of the heater without emptying down the system. The valves shall be 'Myson Radiator Valves or similar to approval. A set of lock shield valve keys shall be supplied and handed over to the Client. A set of lock shield valve keys shall be supplied

and handed over to the Client.

4.5.4 Insulation

The surface of all heating pipes and their fittings in the roof space and in the boiler house shall be insulated with Canvas covered rigid fibreglass sections as per the manufacturer's instructions.

Insulation shall be to the following thickness:

Pipe sizes up to and including 32 mm	25 mm
Pipe sizes from 38 mm to 51 mm	38 mm
Pipe sizes from 65 mm to 75 mm	38 mm
Pipe sizes over 75 mm	50 mm

Insulation shall be Crown, density 80 kg/m³ Canvas covered, ensuring that all joints are well butted together. Longitudinal overlaps to be securely stuck down with suitable adhesive and/or taped with matching tape. Butt joints to be covered with suitable self-adhesive tape not less than 50 mm wide, bends to be insulated with carefully mitred segments of Crown Pipe insulation covered with self-adhesive. All fittings to be insulated to the same standard and finish as adjacent pipework.

4.6 Ventilation and Air Conditioning (Element 57)

- 4.6.1 Supply and install all ventilation ductwork, terminals, and plant within the building.

Connect all ductwork to terminals and louvres.

Insure that adequate access is provided for maintaining the system and bring to the attention of the Contractor, any building access hatches required to allow the system to be maintained, before the system is installed.

Cleaning

Thoroughly clean all components of the ventilation system. Remove all plaster or other construction materials before concealment or handover. Provide a level of cleanliness and protection as defined in HVCA document DW/TM2.

Weatherproofing

Fit ductwork with trimming angle and weather cravat, skirt, flashing plate and cowl where ductwork passes through or terminates in roof, to ensure a weatherproof seal to building structure. All required weather seals must be supplied and installed by the Mechanical Services Specialist.

Sleeves

Enclose ducts passing through building elements, (walls, floors, partitions, etc.) within purpose made sleeves. Cut sleeves of the same material as the duct and pack with mineral fibre or similar non-flammable and fire resistant material to form a fire/smoke stop of adequate rating and to prevent air movement and noise transmission between duct and sleeve.

Manufacturer's instructions

Follow manufacturers' instructions for the storage, preparation, and installation of all equipment, fittings, and materials.

Site Dimensions

Check dimensions on site prior to ordering any equipment or terminals. Any equipment or terminals delivered to site that does not fit or does not have adequate maintenance provision must be returned without cost to the project unless the Employers Representative has been notified of the dimensional difficulties in writing prior to ordering.

Installation and workmanship

Ductwork

Supply and install galvanized steel ductwork and fittings to the standards and dimensions contained within DW144.

Sizes of ductwork shown on drawings are internal dimensions.

Use a member of the HVCA specialising in the trade of manufacturing and installing ductwork for the supply and installation of ductwork and fittings.

Ductwork pressure classification: Class A
Ductwork leakage testing will be required if the Employers Representative deems that it is necessary for the system to be tested in order to confirm that the ductwork has been fabricated to the required air tightness standard. The cost of the test shall be borne by the Mechanical Services Specialist.

Flexible ducts shall be used for final connections to air terminals. The maximum length of a flexible duct used shall be 0.8m.

Flexible joints shall be used on all connections to fans and air handling units. Flexible connections shall run level with ductwork and shall not be used to bridge differences in alignment of greater than 25 mm.

Ensure that there are no sharp edges or corners on ductwork, flanges, and supports. Arrange ductwork to drain any entrained

moisture and ensure the lapping of joints minimises moisture leakage.

Ductwork Access

Provide access panels beside all fire dampers

Provide access panels at all fans

Provide an access panel every 3m to allow for ductwork inspection and cleaning.

Access panels shall be provided hand operated screw fixings and shall be constructed to the same standard as the ducts in which they are fixed.

Ductwork Supports

Support ductwork tight to slabs. Cut drop rods to within 20 mm of drop rod nuts and provide plastic end caps on all drop rods within visible areas.

Bird mesh screens

Fit bird mesh screens with 13 mm square pattern to all intake and extract louvers to atmosphere. Use a wire gauge of no less than 1mm.

Ductwork Insulation

The ductwork contained within the building does not contain treated air and does not require insulation.

Fans

Fans shall be selected at the most efficient part of their operating curve. Fans delivered to site that operate close to the end of their curves must be replaced.

Fans shall be provided with a minimum efficiency of 65% for forward curved fans and 75% for backward curved fans. No fan shall be provided with an efficiency of less than 65%.

Provide back draught dampers on, or beside all fans provided.

CENTRIFUGAL FANS

Drain - fit 20mm drain connection at lowest point of scroll.

Inspection doors - fit air-tight doors in scroll and cover.

Materials

Construct casing entirely rigid and free from drumming under operating conditions.

Fit safety guards on air inlet and air outlet connections where these are freely accessible to personnel in accordance with BS 848-5.

Electrical safety to IS EN 60335-2-80.

Motor Electrical supply to BS 7697

Testing

Where fans approved under CAME scheme are used provide certified data for type.

Where fans are not approved under CAME scheme provide results of aerodynamic performance tests in accordance with BS 848-1 noise tests in accordance with BS 848-2 and fan vibration tests in accordance with BS ISO 1184695.

AXIAL FANS:

Fit air-tight inspection doors giving access to drive motors and other components requiring regular servicing or maintenance.

Construct casing entirely rigid and free from drumming under operating conditions.

Electrical safety to IS EN 60335-2-80.

Motor

Electrical supply to BS 7697

Fit safety guards on air inlet and air outlet connections where these are freely accessible to personnel in accordance with BS 848-5.

Testing

Where fans approved under CAME scheme are used provide certified data for type. Where fans are not approved under CAME scheme provide results of aerodynamic performance tests in accordance with BS 848-1; noise tests in accordance with BS 848-2 and fan vibration tests in accordance with BS ISO 14695.

ROOF EXTRACT UNITS:

Provide sound power data in accordance with BS 848-2.

Electrical safety to IS EN 60335-2-80.

Electrical supply to BS 7697

Fit safety guards on air inlet and air outlet connections where these are freely accessible to personnel in accordance with BS 848-5.

Fit shutters to prevent reverse flow through fan.

Provide access via removable panel.

Testing

Where fans approved under CAME scheme are used provide certified data for type.

Where fans are not approved under CAME scheme provide results of aerodynamic performance tests in accordance with BS 848-1 noise tests in accordance with BS 848-2 and fan vibration tests in accordance with BS ISO 14695.

TOILET EXTRACT UNIT:

Electrical safety to IS EN 60335-2-80

Electrical supply to BS 7697

Access - provide access via removable panel.

Provide auto changeover unit with fan.

Provide Back-draught dampers with fan

TESTING

Where fans approved under CAME scheme are used provide certified data for type.

Where fans are not approved under CAME scheme provide results of aerodynamic performance tests in accordance with BS 848-1; noise tests in accordance with BS 848-2 and fan vibration tests in accordance with BS ISO 14695.

ATTENUATORS:

Use non-flammable adhesives. Ensure that all insulating materials and coverings are non-combustible material covered with a material that complies with flame spread requirements of BS 476-7, Class 1.

Provide Class O surface rating.

Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
Construct casing to DW 144.

Dampers

Dampers shall be provided with twin wall blades, with opposed blade operation.

Any dampers used within natural ventilation strategies shall be provided with air tight seals and shall have a total damper leakage of no more than 5m³/m²/hr at a pressure of 50Pa when in the closed position.

Fire Dampers

Provide fire dampers wherever a duct passes through a fire wall. Fire dampers shall be mounted within the building fabric and securely attached to it.

Supply and install intumescent fire dampers in accordance with manufacturer's instructions.

TESTING, CLEANING AND COMMISSIONING

Fitting of sensors and test holes

Provide test holes in ductwork system to allow complete testing and balancing of system in accordance with CIBSE Commissioning Code Series A.

Site drill test holes on site in accordance with DW144 Part 7 Section 20.6.

Provide holes in metal ductwork, in accordance with DW144 Part 7, paragraph 20.7, to accommodate sensors.

Fill holes that are used only for test purposes with rubber sealing caps.

Balancing of the system

Employ a commissioning Specialist to balance air systems in accordance with CIBSE Commissioning Code A, Section A2.

Provide written commissioning reports to the Employers Representative, demonstrating the air flow rates achieved in comparison to the design flow rates.

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guide for air systems to achieve the standards set in the CIBSE Commissioning Codes.

4.7 Other Services (Element 58)

4.8.1 Fire Protection Services

- 4.8.1.1 The fire protective services consist of the supply and installation of fire extinguishers and fire blankets throughout the school to BS 5306.

4.9 Mechanical Site Services (Element 50)

4.9.1 Gas Supply

4.9.1.1

General

The gas main shall enter the science room, preparation room where a manual isolation valve shall be provided. All gas pipe work above ground shall be painted with two coats of yellow paint by the Mechanical Services Specialist.

Gas check meters shall be provided for the incoming branches in order to provide information on the buildings energy use.

The Mechanical Services Specialist shall ensure that these meters are selected to handle the specified load and are not significantly oversized as this may lead to reading inaccuracies. The Mechanical Services Specialist shall ensure that the meters are installed to the manufacturer's instructions and in particular the manufacturer's recommendations in relation to the straight run of pipe preceding and following the meter.

A regulated gas supply shall be provided to each outlet.

The Mechanical Services Specialist shall include for the cost of gas required to test, commission, and demonstrate the system.

Gas Safety System

A gas safety installation shall be provided in each science room and preparation rooms consisting of the following components:

- Gas Pressure Proving Detection Control Panel
- Gas Shut-Off Valve (with automatic reset)
- Emergency Push Button

The emergency push button shall be located as per the enquiry drawings. Failure to install the button or panel containing the button in this location shall result in the panel being moved by the Mechanical Services Specialist at no cost to the contract.

A slam shut valve with automatic reset shall be provided at the gas source. The Mechanical Services Specialist shall include for the testing and commissioning of the system by the equipment supplier. A commissioning certificate shall be issued on completion with full instructions on the operation of the system

SECTION 5

GENERAL SPECIFICATION

The successful Mechanical Contractor must ensure that all work undertaken and executed in this contract shall comply with all relevant statutory instruments and regulations current at the date of tender, and in particular the following:-

1. The Safety Health and Welfare at Work Act 2006, the Factories Acts and all current Statutory Instruments and Regulations.
2. Any special regulations issued by the local electricity, gas or water authority.
3. Manufacturer's recommendations and requirements.
4. The i.e. Regulations for the Electrical Equipment of Buildings and the E.T.C.I. Regulations.
5. All relevant Irish Standards or where not applicable the British Standards and Codes of Practice.

Introduction

While the detailed project requirements are described within the general technical specification and drawings, the particular specification provides a description of the services installation and draws attention to particular elements of importance.

Where a contradiction exists between any of the tender documents, this should be addressed to the Employer's Representative during the tender period for clarification. If a contradiction is not identified during the tender process then it shall be at the discretion of the Employer's Representative to identify which document takes precedence.

Access

Where access may be required to any element of the services installation for maintenance proposes, the Electrical Services Specialist shall provide details to the Contractor and the Employer's Representative in the form of a marked up drawing prior to the installation of the services. The Electrical Services Specialist shall also inspect the electrical installation prior to the concealment of services to determine if any access points will be required where not previously identified.

The Electrical Services Specialist shall co-ordinate with the Mechanical Services Specialist to minimise duplication of access requirements.

In the event that an access requirement is not identified to the Employer's Representative prior to the installation of the Electrical services, and the Employer's Representative deems that the location of any services elements that require access are not in an appropriate location for visual or practical reasons, then the services element shall be re-located by the Electrical Services Specialist without charge to the contract.

Sample Installations

Distribution Route

Before any internal services are installed, the Electrical Services Specialist shall install a sample section of the main distribution route with a length of 3 meters. This section shall include the following:

- Electrical services trunking and tray
- Any electrical items to be fitted to services trunking and tray (e.g sensors, detectors, etc.).

by Mechanical Services Specialist

- Sections of each type of water pipework to be used on the project.
- Pipework brackets with appropriate insulation / pipework protection details.
- Drop rods to be trimmed and capped.
- Pipework insulation
- Pipework labelling, all pipes (neat, inline, clear)
- Typical joint detail for each type of pipe
- Pipework paint protection

5.1.1 MATERIALS

- 5.1.1 All materials used in the Contract and all of the work done shall be fully in accordance with the qualities and tolerances and all other requirements of the relevant Standards and Codes Practice.
- 5.1.2 The Contractor shall submit lists of alternative materials for approval at or shortly after the time of tender but he must allow in his tender for the inclusion of the specified materials and materials from nominated manufacturers.

5.2 PLANT

- 5.2.1 The Contractor shall provide for the delivery and erection of the plant on site except where otherwise specified together with all labour, tools, erection materials, scaffolding and instruments and all other apparatus necessary for the completion of the Contract.

5.3 STORAGE

- 5.3.1 All goods which are normally stored in the open shall be adequately protected from the weather and from all other damage. Materials which are not adequately protected shall be removed from site on receipt of instruction from the Consultants and replaced by new materials, all at the Contractor's expense.
- 5.3.2 The Contractor shall provide storage and working areas necessary for the smooth continuity of the works. Materials are not to be stored and preparatory work is not to be carried

out within the building, without the express agreement of the Consultants.

5.4 SETTING OUT

- 5.4.1 The Contractor shall set out the whole of the works and be responsible for the correct positioning of all equipment, bases, plinths and for any other builder's work which is necessary for the mechanical contract. The exact courses of all pipe fittings, valves and other items of equipment shall be approved by the Consultant before erection. The Contractor will be liable for making good any work incorrectly carried out by him or by others due to an error on his part.

5.5 BUILDING PROTECTION

- 5.5.1 The Contractor shall be liable to make good any damage which he causes to the building structure or the finishes there of, to the satisfaction of Architect, Engineer and shall remove all rubbish, plant and unused material from the site on completion.

5.6 PIPEWORK GENERALLY

- 5.6.1 All pipework shall be neatly installed to follow the contours of the building vertically and horizontally.
- 5.6.2 Where this pipework passes through the structure it shall do so at an angle of 90 degrees unless approved otherwise by the Consultant.
- 5.6.3 Pipework which does not conform to these requirements or which is misaligned or unsightly shall not be accepted.
- 5.6.4 Pipework must be free to expand or contract throughout the whole of its working temperature range.
- 5.6.5 All components of the installation shall be protected against the ingress of dirt or foreign matter both before and after erection.
- 5.6.6 The piping installation shall be so fitted that no air locking can occur.

5.7. Fitting of Copper Pipework

- 5.7.1 Only top quality workmanship will be acceptable. All bends shall be carefully formed to the exclusion of elbows, so that the section is not altered nor the ends damaged, if any ripples are formed in copper pipe the bends will be rejected.
- 5.7.2 Where pipes pass through walls, floors, ceilings, etc., copper sleeves shall be fitted from next largest size piping. The

pipework shall be spaced and supported by polished cast brass clips with fixing generally built in to suit the location.

5.7.3 PVC pipework shall be installed as per BS. 5255:1976.

5.7.4 In ducts bearer angle irons or channels shall be used for mounting rollers.

4.7.5 Bracket spacing for copper pipe shall be:

Bore:	15/22mm	28mm	35/42mm	54mm	65mm	76mm
Horizontal bare:	1.2m	1.8m	2.4m	2.7m	3.0m	3.0m
Horizontal lagged:	1.2m	1.2m	1.8m	1.8m	2.4m	2.4m
Vertical :	1.8m	2.4m	3.0m	3.0m	3.7m	3.7m

5.7.6 For C.I. piping generally it shall be supported every two meters.

5.7.7 The minimum clearance between pipework and other surfaces shall be 35mm

5.8 Expansion

5.8.1 Pipework shall be arranged to allow freedom of movement for expansion. Fixed anchor points as necessary shall be provided to direct expansion towards expansion loops / bellows as required. All pipe work shall be arranged to prevent expansion stress on all connections to equipment. Drawings showing the position of all anchor / guide points together with anchor and guide details shall be submitted to the Engineer for approval prior to installation.

5.8.2 The Contractor shall be liable for any damage or injury caused by failure or the pipework during the course of the contract or before the end of the Defects Liability Period.

5.9 HYDROSTATIC TESTING

5.9.1 On completion of the works or sections of the works the Contractor shall hydraulically test the various installation to the pressure specified in the presence of the Engineer.

5.9.2 The Contractor shall inform the Consultants reasonably in advance of the time of all hydrostatic testing.

5.9.3 A particular hydrostatic pressure as tabled by the Consulting Engineer shall be applied to pipework and selected plant only and any flaw apparent shall be rectified and the test repeated.

5.9.4 Adjusting valves, controls, circuits, balancing, commissioning of equipment shall be carried out to the satisfaction of the Engineer.

- 5.9.5 The Contractor shall not attempt to repair faulty welds but cut out the leaking section of pipework and renew same unless authorised otherwise by the Consultant.
- 5.9.6 Pressures shall not be exerted on any plant or equipment other pipework unless so scheduled or mentioned herein.
- 5.9.7 It shall be noted that for reasons outside the control of the Engineer he may not be in a position to witness pressure tests. The contractor in this case shall provide a certificate of test to the Engineer at completion of the project.
- 5.9.8 Pressure testing shall only be carried out by trained and experienced staff working under the foremans supervision.
- 5.9.9 Records of all tests shall be supplied by the Contractor to the Engineer.

5.10 FLUSHING OUT OF PIPEWORK

- 5.10.1 The contractor shall flush out the whole of the pipework installations with fresh water once on completion of testing and adjusting procedures and once at the end of tuition period in addition to any plumbing and cleaning necessary during the installation of the works.

5.11 FAN & DUCTWORK INSTALLATIONS

5.11.1.1 Sheet Steel Rectangular Ductwork (low pressure)

This specification is to be read in conjunction with HVCA specification DW/142 and applies to systems in which the average air velocity does not exceed 10m/s and in which the static air pressure - positive or negative - does not exceed 500 Pa for ductwork and 1000 Pa for plant connections.

- 5.11.1.2 The ductwork shall be constructed of best quality strip mill cold-reduced sheet continuously hot-dip galvanised to BS. 2989, Grade Z2 and shall comply with HVCA Specification DW/142. Ductwork shall be fabricated in accordance with good practice in a neat and workmanlike manner, true to size and internally free from sharp edges and obstructions. All ducting must be constructed so that when erected it shall be rigid and free from movement or drumming and truly airtight under all operational conditions. The ductwork shall be Constructed according to the following table:-

- 5.11.1.3 In the above schedule of gauges and metric sizes, the maximum side of the duct shall determine the gauge of metal to be used on all four sides of the duct.

- 5.11.1.4 The stiffening of the ducts shall be provided by the recommended types of cross joints plus intermediate stiffeners as recommended in the foregoing table. It will be noted that bracing requirements are less when panels are

beaded at 300mm maximum centres or alternatively when the four side panels of the duct are cross broken.

- 5.11.1.5 All seamed joints shall be made air tight by the use of ducts. Angles shall be installed flat to flat and rigidly fastened (by welding or bolting with lockwashers) at duct comers. All longitudinal joints will have Pittsburg pattern seams and all ducts shall have panels cross-broken with caps made in the direction of air flow.
- 5.11.1.6 Where small areas of ductwork are altered on site the areas where the galvanising has been destroyed may with the approval of the Engineer, be painted internally and externally will zinc paint plus a suitable finishing coat as detailed in clause 5 of DW/142. All cut ends on galvanised sheets shall be protected by painting with zinc paint.
- 5.11.1.7 Where welding is used in the construction of ductwork or for fixing angle girths the complete duct shall be galvanised after manufacture.
- 5.11.1.8 All edges and slips shall be hammered down to leave a smooth finish inside the duct.
- 5.11.1.9 Where a transformation results in an increase or decrease, the slope of the transformation shall not exceed 35mm in 175mm. The angle of the transformation at connections to any apparatus shall not exceed 15° from a line parallel to air flow in the entry side and 30° on the exit side.
- 5.11.1.10 All ductwork shall be assembled and erected to the best standard practice of the trade and to C.I.B.S.E. standards.
- 5.11.1.11 All changes in direction both horizontal and vertical shall be shaped to permit the easiest possible air flow, and shall be fitted with turning vanes as shown on the drawings.
- 5.11.1.12 Branch take offs shall be arranged to cut or slice into the air stream.

Constructional Requirements - Rectangular Ducts

Table 5 (DW/142) LOW PRESSURE (up to 500 Pa)

Maximum duct size (longer side) or 3000 length of stiffeners	Dimensions in mm								
	400	600	800	1000	1250	1600	2000	2500	
Minimum sheet thickness	0.6	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.2
Type Rating Sheet	Maximum spacing between joints and stiffeners								

Socket & Spigot Joints

A1 PS 3000

A1	SS	3000							
A2	PS	3000	2000	1600	1250				
A2	SS	3000	3000	1600	1250				
A3	PS	3000	2000	1600	1250	1000	800		
A3	SS	3000	3000	200	1600	1250	800		

Cleated Joints

C1	PS	3000	1600						
C1	SS	3000	3000						
C2	PS	3000	2000	1600	1250				
C2	SS	3000	3000	2000	1250				
C3	PS	3000	2000	1600	1250	1000			
C3	PS	3000	3000	1600	1250	1000			
C4	PS	3000	3000	1600	1250	1000	800		
C4	SS	3000	3000	2000	1600	1250	800		

Flanged Joints & Stiffeners

J1/S1	PS	3000	1600	1250	625						
J1/S1	SS	3000	3000	1250	625						
J2/S2	PS	3000	2000	1600	1250	625					
J2/S2	SS	3000	3000	1600	1250	625					
J3/S3	PS	3000	2000	1600	1250	1000	800				
J3/S3	SS	3000	3000	2000	1600	1250	800				
J4/S4	PS	3000	2000	1600	1250	1000	800	800			
J4/S4	SS	3000	3000	2000	1600	1250	1000	800			
J5/S5	PS	3000	2000	1600	1250	1000	800	800	800	625	
J5/S5	SS	3000	3000	2000	1600	1250	1000	800	800	800	
J6/S6	PS	3000	2000	1600	1250	1000	800	800	800	800	
J6/S6	SS	3000	3000	2000	1600	1250	1000	800	800	800	

Notes

In the constructional tables 5:

- (1) The joints and stiffeners have been rated in terms of duct longer side and maximum spacing
 - A1 to A3 - Fig. 9 to 12
 - C1 to C4 - Fig. 20 to 24
 - J1/S1 to J6/S6 - Fig. 33 to 43
- (2) In Col. 3:
 - 'PS' - plain sheet joints and/or stiffeners:
 - or (c) pleating.

A protective finish of two coats of red oxide or lead paint shall be applied to all

M.S. sections (flanges, stiffeners, hangers, supports, etc.) before fixing.

Obstructions such as electric conduits, pipes, hanger rods etc. shall not be permitted to pass through the ducts and the inside of the ducts shall be kept free of any projection that could cause additional friction, loss or turbulence.

5.11.2 SHEET STEEL CIRCULAR DUCTWORK (LOW PRESSURE)

5.11.2.1 This specification is to be read in conjunction with HVCA specification DW/142 and applies to systems in which the average air velocity does not exceed 10m/s and in which the static air pressure - positive or negative - does not exceed 500 Pa for ductwork and 1000 Pa for plant connections.

All notes in section 1 for rectangular ductwork apply to circular ductwork.

The ductwork shall be constructed according to the following tables.

Table 14 SPIRALLY-WOUND DUCTS

	Maximum (nominal) diameter	minimum sheet thickness	Minimum stiffening requirements
	1 mm	2 mm	3
	205	0.6	None
	762	0.8	None
	914	1.0	None
	1020	1.0	None if tube is also helically beaded.
If <i>factory made</i> :	Fig. 75:		
if <i>site made</i> :	Fig. 77 (angle reinforced) or Fig. 78 or 79 (angle flanged)- all at 300 mm maximum spacing. 1525 1.2 Figs. 78 or 79 at 3000 mm maximum spacing.		

Table 15 STRAIGHT-SEAMED DUCTS

Maximum (nominal) diameter	Low and medium pressure	high pressure	Minimum stiffening requirements
----------------------------------	-------------------------------	------------------	---------------------------------------

1	2	3	4
mm	mm	mm	
205	0.6	0.8	Swaged at both ends of all joints
510	0.8	0.8	Swaged at both ends of all joints
762	0.8	1.0	Swaged at both ends of all joints
1020	1.0	1.2	Swaged at both ends of all joints; 30 x 3 mm angle rings at 1250 spacing
1525	1.2	1.2	40 x 4 mm angle rings at 1250 mm spacing

5.11.2.2 BENDS AND ELBOWS (CIRCULAR DUCTWORK)

These may be either of the pressed prefabricated type or segmented. They shall be manufactured in accordance with the Standards as set out in Figs 87 to 93 of H.V.C.A. Specification DW/142 and manufactured from the same gauge metal as the ductwork to which they are attached.

5.11.2.3 FLEXIBLE DUCTWORK

Where flexible connections are indicated or required between rigid ductwork and particular components or items of equipment the internal diameter of the flexible duct shall be equal to the external diameter of the rigid ductwork between rigid sections of sheet metal ductwork to change direction or plane will not be permitted except where indicated or expressly authorised by the Engineer.

5.11.2.4 Flexible ductwork shall consist of a P.V.C. coated fibre glass grid bonded to P.V.C. coated steel wire helix and covered with 12mm thick glass wool insulation finally coated in P.V.C. covered glass fibre fabric.

The joins to rigid spigots shall be sealed with a brush coat of pipe jointing paste or mastic compound and then sealed with 75mm wide self-adhesive vinyl tape. Ducts up to 150mm dia. shall be secured with a worm drive type hose clip complying with BS. 3628. Ducts over 150mm dia. shall be secured with a band clip.

5.11.2.5 The frictional resistance to air flow per unit length of the flexible duct shall not exceed 50% more than the frictional resistance per unit length of galvanised steel ducts of equivalent diameter. The radius ratio R/D for bends shall not be less than 2 where R is the centre line radius and D is the diameter of flexible duct.

5.11.2.6 The leakage from any section of flexible duct shall not exceed 1% of the design air flow rate at the static operating pressure.

5.11.2.7 Flexible ducts shall be suitable for an operating temperature range of -18° C to 120° C and shall comply with BS. 476 Parts 5, 6, 7 and shall be similar to type 'C' as manufactured by Zest Equipment Co. Ltd. or equal to approval.

5.11.3 GRILLES, REGISTERS AND DIFFUSERS

Where shown on the drawings, grilles, registers and diffusers of the sizes, type and with the finish indicated on the drawings and in the Particular Specification shall be Provided and installed.

Grilles shall be of steel, aluminium or P.V.C. as indicated in the drawings or the Particular Specification. Steel grilles shall be protected against rusting and shall be supplied in a fully finished condition. Aluminium grilles shall have an epoxy resin silvertone finish unless stated otherwise in the Particular Specification. Grilles shall not be less than the size indicated on the drawings or in the Particular Specification and where no size is shown they shall be capable of dealing with the air flow and distribution without producing noise. All grilles except those on exposed ductwork shall incorporate an edge seal and dampers shall be provided with felt or sponge washers to ensure tightness.

5.11.3.1 Position of Outlets

The position of outlets shown on the drawing are approximate only. The contractor shall check the location of each outlet with the architect's reflected ceiling plan, etc. and shall make such adjustment in positions as are necessary to ensure their conforming with the architectural features of the ceiling tile pattern.

5.11.4 DAMPERS

Dampers will be provided in ductwork where necessary to obtain proper control, balancing and distribution and as indicated on the drawings. In general dampers will be provide the following functions (1) isolation, (2) balancing and (3) control. These dampers shall be separate and independent from the dampers to be provided behind supply and return air outlets.

5.11.4.1 Isolation Dampers

These dampers will be fully open or fully closed and can be hand or power actuated. Dampers shall be similar to Actionair air/shield stainless steel damper or equal to approval.

5.11.4.2 Balancing Dampers

These dampers are required to achieve the required air distribution throughout the ventilation system. This damper requires to be locked in place on completion of balancing. Dampers shall be of the multi-leaf opposed or parallel blade type pivoted to turn easily and provided with an approved locking and operating devices mounted outside the duct in an accessible place. Dampers shall be similar to Actionair air/shield stainless steel aerofoil control damper or equal to approval.

5.11.4.3 Control Dampers

These dampers are required to achieve dynamic control of air in the ventilation system. This damper will always be power actuated and can be open/closed or fully modulating. Dampers shall be of the multi-leaf opposed or parallel blade type pivoted to turn easily and provided with an approved locking and operating devices mounted outside the duct in an accessible place. Dampers shall be similar to Actionair air/shield stainless steel aerofoil control damper or equal to approval.

5.11.4.4 Iris Dampers

Iris dampers can be used on circular ductwork up to 460mm dia. for isolation, balancing and control.

5.11.5 FIRE DAMPERS

Fire dampers are required in the air distribution ductwork to contain fire and smoke. They will be required where ductwork penetrates any fire barrier and must have a fire test certificate of equal or greater rating to that of the fire barrier.

5.11.6 DUCT HANGERS AND SUPPORTS

Supports for horizontal ducts shall be made from galvanised M.S. flat bar or rod in accordance with the following Table No. 24 A of DW/I42

In cases such as parallel runs of hot and cold ventilation ducts, special suspension systems in accordance with the details on the contract drawings will be utilised.

Supports vertical ducts will have a spacing greater than listed for horizontal ducts and details of the type of supports to be used will be included in the contract drawings. In general vertical ducts should be supported at the ductwork stiffener angles and should this not be possible then extra support angles will be fastened to the ductwork.

Hangers for ductwork will generally be fastened at the upper end, to the underside of concrete floors by means of

threaded studs (Hilti type) or by expanding type concrete anchors (Rawlplug, etc.) and to metal decking and structural steelwork by means of special clamps or studs welded to the steelwork with the approval of the Engineer.

Supports and hangers shall be provided with a foam plastic insert secured to the ductwork with a suitable adhesive and fitted over the whole surface between the hanger and the ductwork.

The dimensions included in Table 24A are to be regarded as minima.

The maximum spacing set out in Table 24A are related solely to duct weight considerations. Closer spacing may be required by reason of limitations of the building structure or to achieve necessary rigidity.

Rolled steel channels may be used as bearing members provided they meet the design characteristics of the bearing members tabled above

TABLE 24A (DW/142)

SUPPORTS for HORIZONTAL DUCTS –
Rectangular, Flat Oval and Circular

5.11.7 FANS

All fans shall be as shown on the drawings and detailed in the Particular Specification and be guaranteed to fulfil the specified requirements and be of the silent running type.

The contractor and the manufacturer shall be held responsible to replace any fans found unsatisfactory in this regard without added cost to the owner. Impellers shall have ample strength and shall be statically and dynamically balanced to avoid vibration. Fans shall have direction of rotation, discharge direction and arrangement to suit the space conditions and the service.

Cups or oil chambers must be provided in accessible locations. Generally belt driven fans shall have pulleys of the adjustable ratio type sized to give the required fan speed with the motor pulley at about the middle of its range or adjustment. Belts shall be multiple with a minimum of two and shall be designed to carry the load with one belt broken. Belt driven fans shall be provided with a suitable belt guard which shall be provided with a warning label to ensure that the guard is not removed with the fan operating.

All fans shall be mounted according to manufacturers recommendations for silent running and shall be fitted with the manufacturers recommended anti-vibration mounting.

5.11.7.1. Roof Extract Fans

These shall be of the mixed flow roof mounted type of the size and duty specified on the drawing and in the Particular Specification.

They shall be complete with automatic shutters fitted with noise eliminators in the form of neoprene foam strips.

5.12 TESTING & COMMISSIONING

5.12.1 General

- 5.12.1.1 The Contractor shall ensure that the completed installations operate in conformity with the requirements of this Specification and with all Local Authority and Statutory requirements, codes and standards.
- 5.12.1.2 The Contractor shall include for carrying out all necessary commissioning procedures and for recording same. Upon completion, shall certify in writing to the Engineer that these procedures have been carried out.
- 5.12.1.3 Only when the installations have been so certified and all test figures and other relevant information has been recorded in the prescribed manner and accepted by the Engineer, shall the works be considered practically complete.
- 5.12.1.4 Commissioning procedures shall be in accordance with current editions of the Commissioning Codes as published by the Chartered Institution of Building Services Engineers as follows:-

series A	-	Air Distribution Systems
series B	-	Automatic Controls
series C	-	Boiler Plant
series R	-	refrigerating Systems
series W	-	Water Distribution Systems

In addition commissioning procedures shall also accord with:-

B.S.R.I.A.	Manual for Regulating Water Systems
B.S.R.I.A.	Manual for Regulating Air Conditioning Installations
I.E.E.	Regulations for the Electrical equipment of Buildings
H.V.C.A.	Publication DW142 & DW143

- 5.12.1.5 Certain plant and equipment are required to be inspected by the Employer's Insurance Company as indicated in Part 4 of this document.
- 5.12.1.6 When these tests have been carried out in the presence of and to the satisfaction of a representative of the Insurers, the Contractor shall provide the Insurer with a certificate indicating that the work has been completed and the necessary tests have been carried out as specified in Part 4 of this document.
- 5.12.1.7 All testing and commissioning, the submission of all test results, the demonstration of the operation of the installations to the Engineer, and acceptance checks by the Engineer, all to be completed within the overall Contract Programme.
- 5.12.1.8 Commissioning and balancing of all systems of the Mechanical Services Installation may be completed by Specialist Sub-Contractors which will be approved by the Engineer.

5.12.1. Commissioning and Testing Definitions

- (i) Commissioning - the advancement of an installation from the stage of static completion to full working order to the specified requirements.
- (ii) Testing - the evaluation of the performance of a commissioned installation.
- (iii) Preliminary Checks - are those checks necessary to be carried out by the Contractor to ensure that the system(s) are in a satisfactory and safe condition for start-up.
- (iv) Setting to Work - is that work necessary by the Contractor to achieve system(s) operation in conformity with the design intent.
- (v) Performance Evaluation - Is that work necessary by the Contractor to ensure that the performance of the system is in accordance with the design intent.
- (vi) Demonstration - is that work necessary by the Contractor in showing the Engineer that the system(s) installed operate in conformity with the design intent.
- (vii) Acceptance Checks - shall be the witnessing by the Engineer of demonstrations arranged by the Contractor or independent checks carried out by the Engineer.

5.12.2. Commissioning Records and Test Certificates

- 5.12.2.1 The Contractor shall provide the Engineer with detailed record sheets (three copies) including test certificates showing the results of all construction tests, regulation procedures and performance tests properly related to the specified requirements. These shall subsequently be modified by the Contractor as necessary to reflect any further adjustment to test results arising from Demonstrations and/or Acceptance Checks as witnessed by the Engineer.
- 5.12.2.2 Similarly three copies of manufacturers test certificates for all items of plant and equipment whatsoever supplied under this Contract shall be provided to the Engineer at the time such plant and equipment is delivered to the site.
- 5.12.2.3. In addition further copies of- all final test certificates shall be included in the Maintenance and Operating Instructions.
- 5.12.2.4 Each Test / Commissioning Certificate shall contain the following minimum information:-
- Project Name.
 - Identification of equipment / identification of installation and section of installation being tested.
 - Date tests carried out.
 - Results.
 - Observations / Comments.
 - Tests carried out by.
 - Tests witnessed by.

5.12.3 Construction Tests

- 5.12.3.1 Any item of plant and equipment supplied and installed by the Contractor shall be capable of withstanding the pressures and temperatures under which they are required to operate, and shall be works tested in accordance with the relevant Local Authority or Statutory Requirement and British and Irish Standard specifications. In addition site testing shall be carried out in the presence of and to the satisfaction of the Engineer or his appointed representative.
- 5.12.3.2 Tests may be carried out in sections as the work proceeds, but a final test of each installation will be required on completion.

Construction tests shall include:-

5.12.3.2.1 Pipework Distribution Systems (Water)

Hydraulic tests shall be carried out on all distribution pipework systems prior to the application of thermal insulation / finishing and or before the system or any part thereof is concealed in any other way. Such tests shall include all plant, equipment and components incorporated in the systems unless otherwise agreed by the Engineer.

5.12.3.2.2 Hydraulic tests shall be applied at the test pressures scheduled hereunder or as laid down in the appropriate section of Part 4 of this document for a period of not less than 2 hours.

LPHW pipework	10	bar
Mains water pipework	6	bar
Domestic cold water pipework	6	bar
Domestic hot water pipework	6	bar
Chilled water pipework	10	bar
Condenser water pipework	6	bar
Gas	6	bar
Oil	6	bar
Fire Fighting	1.5	bar

5.12.3.2.3 Water Storage Tanks, Cisterns and Condensate Drainage Pipework

All tanks, cisterns and drainage pipework shall be filled with clean water and subjected to a standing leak test for twenty four hours. Such tests shall be completed prior to the application of any thermal insulation/finishing.

5.12.3.2.4 Safety Relief Valves

All safety/relief valves shall be checked by hydraulic pressure test to ensure lift at normal working pressure plus 115% of working pressure.

5.12.3.2.5 Ductwork Distribution Systems

Systems under this heading shall be deemed to include all items of plant and equipment and connections thereto, plant and equipment and sheet metal ductwork connections to external louvers and builders work structures, timber frames and the like, all ductwork fittings, components, access doors,

controlling or sensing element penetrations, terminal devices and test holes.

- 5.12.3.2.5 The sheet metal ductwork systems shall be visually inspected for air tightness before any insulation is applied and prior to running the fans.
- 5.12.3.2.6 All high velocity/high pressure ductwork and low velocity/pressure ductwork when so indicated shall be tested for air leakage. Air leakage tests shall be carried out in accordance with HVCA standard specification DW 143.
- 5.12.3.2.7 Whether or not duct pressure tests are specified, the Contractor shall be responsible for sealing all ducts and for ensuring that excessive air leakage does not occur.
- 5.12.3.2.8 All connections to airways of builder's work construction and points of penetration through the enclosing structure shall be sealed at the time of construction by the Building Contractor. There-after the Contractor shall inspect such joints up to the time of handover and shall report any failure of the sealed joints due to building shrinkage, vibration or any other cause to the Engineer.

5.12.4. Pre-Commissioning Cleaning and Checks

- 5.12.4.1 The Contractor shall ensure that all equipment included under this Contract is thoroughly cleaned, lubricated and checked for serviceability immediately before setting to work. Particular attention is drawn to the removal of dust and debris from the air system, motors, fan bearings, pipework systems etc.
- 5.12.4.2 All safety devices shall be inspected and checked for proper operation before the electricity is applied to the system, or it is started up.
- 5.12.4.3 All pipework systems shall be thoroughly flushed to ensure that all foreign matter is removed prior to filling the systems.
- 5.12.4.4 If abnormal deposits continue to collect after such cleaning the Engineer reserves the right to call for further cleaning and flushing operations until the systems are free from foreign matter. The costs of such further cleaning operations, the refilling of systems and application of water treatment, shall be borne by the Contractor.

5.12.5 Setting to Work and Regulation

- 5.12.5.1 The Contractor shall satisfy himself that the internal cleanliness and general conditions of the system(s) is satisfactory before they are set-to-work. He shall also

arrange for any necessary temporary protection of anything within the spaces served by the system, which could be damaged by the operation of the system.

5.12.5.2 Setting-to-work, regulation and calibration of all systems shall then be carried out in accordance with specified or appropriate procedures.

5.12.5.3 Setting to work and regulation procedures shall include, but is not limited to the following:-

5.12.5.3.1 Heating Systems and Equipment

Heating systems shall be balanced with all circulation rates being set to accord with the respective design values. All heating equipment; radiators, fan convectors, convectors, pipe coils etc. shall be checked for satisfactory operation. All associated controls (environmental and safety) shall be calibrated, set and checked to ensure their operation meets the specified requirements.

5.12.5.3.2 Domestic Hot and Cold Water Services

Circulation rates shall be checked and adjusted as required to achieve satisfactory flow at all outlets. The secondary HWS flow rates shall be adjusted using the regulating and flow measurement facilities provided.

5.12.5.3.3 Air Distribution systems and Equipment

Air distribution systems shall be proportionally balanced using the volume control dampers to achieve the specified air volumes. The duties of all pre-set terminal units shall be verified and reset if required.

5.12.5.3.4 Motorised volume control dampers shall be set in their optimum positions during balancing operations. All associated controls (environmental and safety) shall be calibrated, set and checked to ensure their operation meets the specified requirements.

5.12.5.3.5 Chilled Water System and Equipment

As per heating system and equipment.

5.12.5.3.6 Condenser Water system and Equipment

As per heating system and equipment.

5.12.5.3.7 Fire System

Check and adjust for satisfactory flow rates at all outlets.

5.12.5.3.8 Gas Installation

Check and adjust for satisfactory flow rates and pressures at all gas burning appliances; record gas pressure at each appliance. All associated safety controls shall be calibrated, set and checked to ensure their operation meets the specified requirements.

5.12.5.3.9 Boiler Room

A boiler combustion efficiency test shall be carried out based on the flue gas analysis taken at the flue gas outlet from the boiler.

5.12.5.3.10 Instruments and Gauges

All instruments, gauges and other indicating or measuring devices shall be checked for accuracy of reading.

5.12.5.3.11 Electrical Equipment

All associated electrical equipment, control panels etc. shall be checked in conjunction with electrical contractor for satisfactory operation including all switching, control and indicating circuits. Motor starter overloads shall be correctly adjusted in relation to normal running current. All interlocks with fire alarm and BMS systems shall be used. Electrical equipment shall generally be checked in accordance with the requirements of the documents referred to in Clause C.14.1 of this Section of the specification.

5.12.5.3.12 Performance Evaluation

Before offering the installations to the Engineer for acceptance the Contractor shall satisfy himself that the systems are achieving the design intent by carrying out such performance tests as he may deem necessary.

5.12.5.3.13 The Contractor shall provide all necessary test instruments, measuring point adapters, and equipment required in carrying out regulation, calibration and performance tests and shall provide same for the Engineers use to check tests which have been carried out.

5.12.5.3.14 Performance testing shall be deemed to include any tests which are requested by the

Engineers, to demonstrate compliance with the Specification.

- 5.12.5.3.15 The performance of the systems shall be monitored under normal Winter and Summer weather conditions and with the building in normal occupation. Following Winter and Summer performance monitoring the Contractor shall submit a written report to the Engineer recording all measurements taken against appropriate design values. The Contractor must allow in his Tender for returning to site to comply with this requirement.

5.12.6 Acceptance Checks

- 5.12.6.1 On completion of the commissioning process the Contractor will be required to demonstrate to the Engineer that the systems are operating in accordance with the design intent.
- 5.12.6.2 The contractor shall give the Engineer at least ten days notice in writing when requesting acceptance tests on any portion of the works. The application must certify that the agreed commissioning procedures and performance tests have been carried out.
- 5.12.6.3 The application must be accompanied by a complete set of records which shall include all plant settings, fluid flow rates, temperatures and pressures, space conditions and noise levels as adjusted by the Contractor, related to the respective design values and all pump and fan characteristics.
- 5.12.6.4 Any application that is not accompanied by the test records may be rejected.
- 5.12.6.5 The precise nature, methods of measurement and presentation of commissioning record information, shall be the subject of prior agreement between the Contractor and the Engineer.
- 5.12.6.6 The Contractor shall demonstrate to the Engineer the satisfactory operation of all systems. He shall also demonstrate that adequate access for inspection and maintenance has been provided.
- 5.12.6.7 When all demonstrations have been completed and accepted by the Engineer the commissioning record information shall be updated as necessary and such records shall form part of the manual of Operating and Maintenance Instructions, called for elsewhere in this document.

- 5.12.6.8 Whilst acceptance checks are in progress the Contractor shall have staff available (including representatives of specialist suppliers as necessary) to operate and adjust the systems as may be required by the Engineer. The staff available shall be fully conversant with the installations and the commissioning and testing procedures. The period during which staff must be available shall include that required for any preliminary operation of the plant in preparation for demonstrating the installation to the Engineer.

5.13 ELECTRICAL WORK

- 5.13.1 Electrical wiring shall be carried out by others. Electrical equipment, other than that forming part of Mechanical Engineering plant, shall be handed to the Electrical contractor on site who will erect it to the Mechanical Contractor's instructions and the Consultant's approval.
- 5.13.2 The Contractor shall liaise with his Electrical Subcontractor and advise his operatives when the installation shall be regarded as live.

5.14 PROTECTION OF THE INSTALLATION AGAINST DAMAGE

- 5.14.1 The contractor is to take all necessary precautions to protect the installation against damage from any cause including frost up to the time the building is handed over to the school manager.

5.15 COMPLETION

- 5.15.1 The Contractor shall complete the work in strict accordance with the specification and drawings, apart from any authorised variations and shall leave same in working order to the entire satisfaction of the Architect or Heating Engineer within the period of the building contract.

5.16 OPERATING INSTRUCTIONS

- 5.16.1 The Contractor shall allow for operating the complete works under full working conditions and for instructing the person nominated by the Employer
- 5.16.2 The employers staff shall be instructed in the correct and most efficient manner for operating installation for a period of one week. He shall give instruction on the maintenance of the plant and equipment etc., including handing over drawings, charts etc., showing pipework as fitted, number and location of each valve, pump etc.
- 5.16.3 No oil fired, gas fired or electrically driven equipment supplied or installed under this contract shall be

started up without the suppliers commissioning staff present and then only on their instruction.

- 5.16.4 Gas pipework shall be tested and purged in accordance with Irish Standards and Codes and gas shall only be turned by agreement with the supply authority.

Storage and transport of gas bottles for welding and purging shall be in accordance with Safety Regulations.

- 5.16.5 All hot work shall be properly planned, and protective blankets and fire extinguishers shall be to hand.

- 5.16.6 No work shall take place in confined or stagnant air areas until adequate temporary ventilation has been put in place. Any area in which gas may collect shall be checked with portable gas detector, and confirmed safe before any work takes place.

5.17 Utilities Providers

- 5.17. 1 The Contractor shall be responsible for liaising with local providers of both Gas (Bord Gais) and Water (Local Water Authority) in relation to the provision of these services including all associated costs in connection with obtaining a supply of these services and for actually making the connections under the supervision of the providers representatives.

5.18 Painting

- 5.18.1 All hanger, supports, steelwork etc., unless galvanised shall be thoroughly wire brushed and given one priming, one flat and one gloss coat of heat resisting paint.
- 5.18. 2 All plant items in boiler house, tank room etc., shall be repainted as directed as well as all exposed uninsulated pipework.

5.19 Labels and Identification

- 5.19.1 All valves, stopcocks and items of plant shall be clearly labelled in material suitable for the location and to the approval of the Engineer to indicate their purpose. Each shall be numbered, the number to agree with that shown on the valve or other equipment chart. All pipework or its covering shall be painted with identification bands generally to BS. 1710 so as to enable the pipe to be readily recognised at any position.

5.20 Spares and Tools

- 5.20. 1 A list of recommended spares obtained from the various plant suppliers shall be supplied not later than the physical completion date for the plant.

5.20.2 All tools necessary for operation and maintenance of the plant shall be supplied to the Client not later than the termination of the maintenance period.

5.20.3 The Contractor shall also supply as part of this Contract any special tools or appliances necessary for easy dismantling and re-assembly of the equipment.

5.21 Schedule and Charts

5.21.1 Schedules and charts of all equipment and valves shall be provided in the boiler room or elsewhere as may be directed. These shall be mounted in a glazed hardwood framed display along with a diagrammatic or similar drawing of the complete installation.

5.22 Operating & Maintenance Manuals

5.22.1 The mechanical contractor shall produce the Operating & Maintenance Manuals and hand 1no. copy to the Engineer for comment within 14 days of the handover of the project. This copy will be returned with comments and the mechanical contractor shall correct the Manual and resubmit the corrected copy of the Manual to the Engineer within 7 days.

5.22.2 The mechanical contractor shall submit to the Engineer the other 2no. copies of the corrected information for distribution to the relevant parties.

5.22.3 The contents of the Manual shall be in a logical sequence, each section being indexed for easy reference.

5.22.4 The Manual shall be fully indexed and the whole contained ring binder format of good quality.

The Manual shall include the following sections:-

- (i). Introduction
- (ii). General Description of Systems
- (iii). Design and Performance
- (iv). Technical Data
- (v). General Operation & Maintenance Notes, including Operation of Controls
- (vi). Procedure for Operating & Maintenance
- (vii). Emergency Procedures
- (viii). Fault Tracing
- (ix). Maintenance Schedules and Recommended Interval Periods
- (x). Commissioning Reports
- (xi). Spares
- (xii). Test Certificates
- (xiii). Valve Charts
- (xiv). Manufacturer's Literature and Schedule of

Equipment
(xv). As Fitted Drawings

(i) Introduction:

This shall include the preamble, together with a list of abbreviations and a schedule of record drawings. A list of contact names and addresses of installers and other 'helpful' companies or authorities are to be included.

(ii) General Description of Works:

A full description of the whole system together with schematic sketches to enhance the explanatory notes. This section should be written in a form that could be easily understood by non-technical persons.

(iii) Design and Performance:

This shall show full details of equipment performance, together with the design operation temperatures

(iv) Technical Data:

This shall identify the technical data for each item of equipment. General Operations & Maintenance Notes:

This section shall indicate measuring techniques and necessary equipment to check the equipment performance on a periodical basis. This section shall also give safety precautions, planned maintenance and equipment log.

(v) Procedure for Operating & Maintenance:

This section shall cover normal operation, initial setting up, routine inspection, draining down water systems (if applicable), replacement and adjusting for drive belts, renewing filters, greasing filters, greasing motor bearings etc..

(vi) Emergency Procedure:

This section shall demonstrate isolation procedures of all equipment, together with all First Aid actions.

(vii) Fault Tracing:

A general description of how to locate faults with the equipment, including a description of fault diagnostic systems of individual systems.

(viii) Maintenance Schedules and Recommended Interval Periods:

This section shall give frequencies of inspection, lubrication, adjustment, replacements, overhaul, together with log sheets which shall have the headings date, details, action taken, signature'.

(ix) Commissioning Reports:

Within this section shall be placed copies of all the commissioning and test results.

(xi) Spares:

This section shall list all the spares recommended by the equipment manufacturers.

(xii) Test Certificates:

This section shall contain all the test certificates as detailed within this specification

(xiii) Valve Charts:

If applicable to the project, this section shall contain the valve charts and schedules.

(xiv) Manufacturer's Literature:

This section shall contain all manufacturer's literature applicable to the installation

(xv) As Built Drawings:

All "As Built" drawings shall be placed in this section

SECTION 6

SCHEDULE OF DRAWINGS

MECHANICAL SERVICES DRAWINGS

- M1 HEATING SERVICES
- M2 WATER DISTRIBUTION SERVICES
- M3 GAS, DRAINAGE, VENTILATION & FIRE SAFETY SERVICES
- M4 MECHANICAL SITE SERVICES

SECTION 7

MECHANICAL SERVICES PRICING DOCUMENT

ITEM	DESCRIPTION	€ / c
7.1 HEATING CENTRE (51)		
7.1.1 Boiler Plant		
1	Amount for new Boiler plant.	
2	Amount for supply and installation of boiler house pipework, valves, motorised valves, balancing valves, strainers and heating circulation pumps	
3	Amount for supply and installation of supply and return headers.	
4	Amount for the supply and installation of boiler house pipework insulation.	
7.1.2 Control Systems		
5	Amount for the extension of the existing boiler house panel and new remote boiler house panel complete with all associated equipment as specified.	
7.1.3 Testing and Commissioning		
6	Amount for the re-commissioning of boiler house plant, equipment and pipework.	
Total for Heating Centre to Summary		

ITEM	DESCRIPTION	€ / c
7.2 DRAINAGE & REFUSE DISPOSAL		
1	Amount for supply and installation of all above ground soil & vent waste services, including all pipework, fittings, vents and cowls.	
2	Amount of the supply and installation of all vulcatine wastes, pipework, fittings, vents and cowls. Supply and install dilution pots and Vulcathene waste pipes from each sink	
Total for Drainage & Refuse Disposal		

ITEM	DESCRIPTION	€ / c
7.3 WATER DISTRIBUTION		
1	Amount for supply and installation of all cold water services, pipework including valves and insulation. Supply and install new 500ltr CWST and Booster pump	
2.	Amount for supply and installation of hot water services pipework including isolation valves and insulation.	
3.	Amount for supply and installation of undersink water heaters.	
4.	Amount for supply and installation of thermostatic mixing valves .	
5.	Amount for supply and installation of all mains water services pipework including isolation valves and insulation.	
6.	Amount for the supply and installation of in house water meter and external taps.	
7.	Amount for the supply and installation of 2 no. emergency eye wash stations.	
8.	Amount for the commissioning of the entire system upon completion.	
Total for Water Distribution		

ITEM	DESCRIPTION	€ / c
7.4 VENTILATION		
1	Amount for supply and installation of all extract duct work, fans and grilles from the preparation room.	
2.	Amount for supply and installation of all ventilation duct work, fans, grilles, stays and supports from fume cupboards.	
3.	Amount for all ventilation controls.	
4.	Amount for the commissioning of the entire system upon completion.	
Total for Ventilation		

ITEM	DESCRIPTION	€ / c
7.5 FIRE PROTECTION		
1	Amount for supply and installation of all fire extinguishers and associated equipment.	
Total for Fire Protection		

ITEM	DESCRIPTION	€ / c
7.6 GAS SERVICES		
1	Amount for supply and installation of complete gas distribution pipework.	
2.	Amount for supply and installation of 3 no. gas pressure proving systems.	
3.	Amount for supply and installation of solenoid valves and valve sets.	
4.	Amount for supply and installation of all bench top double gas cocks.	
5.	Amount for the commissioning of the entire system upon completion.	
Total for Gas Services		

ITEM	DESCRIPTION	€ / c
7.7 SPACE HEATING		
1	Amount for supply and installation of complete 1.5mm radiators and associated valves.	
2.	Amount for supply and installation of complete pipework.	
	Supply and install new pipework to zone the science labs separately from the tech room	
3.	Amount for supply and installation of complete motorised valves and room thermostats.	
4.	Amount for the commissioning of the entire system upon completion.	
Total for Space Heating		

ITEM	DESCRIPTION	€ / c
7.8 MECHANICAL SITE SERVICES		
1	Amount for cold water supplies from existing system.	
2.	Amount for mains water supplies from existing system.	
3.	Amount for heating supplies from existing system.	
4.	Amount for gas supplies from existing system.	
5.	Amount for the commissioning of the entire system upon completion.	
Total for Mechanical Site Services		

ITEM	DESCRIPTION	€ / c
7.9 INDIRECT COSTS		
	Preliminaries	
1	Amount for the provision of contractors plant and equipment.	
2	Amount for the provision of contractor set up including offices, stores, etc. as deemed necessary by the contractor.	
3	Amount for the provision of contractors on site supervision.	
4	Amount for the provisions of contractors overheads.	
5	Amount for the mechanical contractor to assist the Project Supervisor at Construction Stage under the current Health & Safety Regulations for complete mechanical services installation and associated works.	
6	Amount for the collection and disposal of all debris, rubbish etc. generated from the building works and maintenance of school interior during works.	
7	Amount for compilation of As Built documentation and Manuals for the complete mechanical installation.	
8	Amount in respect of costs deemed to be included by the contractor.	
	<i>Insurances</i>	
9	Amount for general insurances.	
10	Amount for the provisions of particular insurances.	
11	Amount to be included for commissioning services	
	Total for Indirect Costs	

Summary

7.1	Total for Boiler Plant	€	
7.2	Total for Drainage & Disposal	€	
7.3	Total for Water Distribution	€	
7.4	Total for Ventilation	€	
7.5	Total for Fire Protection	€	
7.6	Total for Gas Services	€	
7.7	Total for Space Heating	€	
7.8	Total for Mechanical site Services		
7.9	Indirect Costs	€	

TOTAL €