



Client:

Colooney National School,
Colooney,
Co Sligo

Project:

New Classroom Extensions

Mechanical Engineering Services
Specification

Issue:

Tender (T0)

18-08-2026

A1172

Revision	Date	Prepared By	Approved By
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BRIEF

This project consists of the new Mechanical Services installation for the New Extensions to Colooney National School, Colooney, Co Sligo.

M100 Space Heating & Ventilation Services

New low water content radiators shall be installed in locations as indicated.

Temperature control shall be by room thermostats effecting 2-port motorised valves in rooms & corridors as shown. 2-port motorised valves shall be individually wired through the local room thermostat.

The existing heating is to be altered to accommodate the new extension:

- Existing corridor pipe work to be removed and the rads in the corridor relocated

The toilet areas are to be provided with in line extract fans controlled off local PIRs and a run on timer. The fans are to be provided with a local speed controller for commissioning.

The existing boilers and 2 circuits are to be retained with some modifications to the distribution pipe work.

The heating services to and within the prefab are to be stripped out so that the prefab can be removed from site.

M300 Water Services

The existing water services pipework is generally concealed above the ceiling. The existing water services pipework is to be retained. There are some minor modifications required as noted on the drawings.

There is an existing rain water collection service installed in the school. This is to be extended to serve the new WCs in the new extensions.

New pipe work for the extension is to run in the ceiling void and drop at locations indicated on the drawing.

The existing water services within the prefab are to be stripped out so that the prefab can be removed from site.

There is also an external tap on the prefab to be removed.

All concealed pipework is to be insulated both hot & cold.

Hot water is to be provided via under sink water heaters in the new extension.

ELEMENT 51 – HEATING CENTRE

LPHW PIPE WORK

The Mechanical Contractor shall supply and install the LPHW water pipe system as shown in the drawings. The system shall comprise piping, pumps, pipe insulation, valves, measuring valves, controls and pipe supports.

The Pipe work is to be mild steel.

Refer to General Specification also.

IDENTIFICATION AND LABELLING

Refer to General Specification.

TYPE OF PIPEWORK INSULATION

Refer to General Specification.

INSULATION JACKETS

Refer to General Specification.

WATER TREATMENT

Refer to General Specification.

TESTING & COMMISSIONING

Refer to General Specification.

ELEMENT 53 – WATER DISTRIBUTION

WATER SERVICES PIPE WORK

All water services pipe work is to be plastic pipe suitable potable water.

All hot water and hot water return pipe work is to be insulated.

UNDER SINK WATER HEATER

Hot water for the extension is to be provided by means of electrical instantaneous or storage under sink water heaters as indicated on the drawing. The water heaters will have a capacity as listed below. The water heaters are to be connected to the cws extended from the existing building. Non return valves and an expansion vessel are to be installed on each storage undersink water heater. The electrical water heaters should create minimal static resistance.

The water heaters will be controlled via a time clock located in the respective classroom above the sink, supplied by others.

The water heaters are to be installed at low level and concealed with access provided to front top and sides.

Wash Hand Basins: 2.8 kW instantaneous water heater

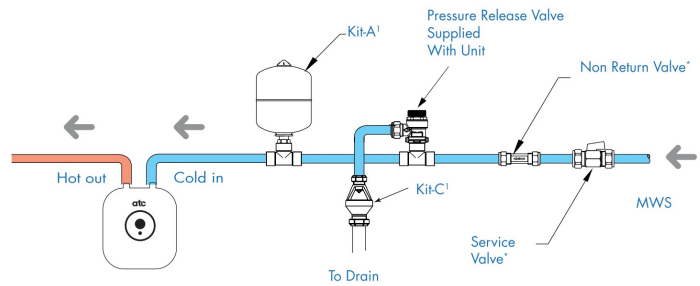
- Compact electronically controlled instantaneous water heater for hand washing.
- The most energy efficient way to directly heat water electrically - affordable and reliable.
- Stainless steel bare wire heating element for quick water heat up time.
- Innovatively designed system that heats water automatically as it flows through.
- Heating power is switched on automatically once the minimum flow rate is exceeded.
- Power rating 2.8 kW @ 230V
- Temperature and flow adjustable of installation between 1.2-1.7 adjustable between 30-43°C.
- Water temperature electronically controlled to maintain factory 38°C.
- Mechanical safety thermal prevent over temperature heating

Sinks: 10 Litres capacity 2kW c/w adjustable temperature control

- High density polyurethane foam insulation which reduces radiant heat loss, reduces energy consumption and ensures high energy efficiency.
- Exclusive dry powder porcelain enamel tank lining delivering twice the corrosion resistance of ordinary glass lining.
- Fitted with heavy duty seamless bolt – on square flange type heating elements which are more durable and efficient.
- Fitted with premium protective magnesium anode rod which equalises aggressive water action and provides extra protection against corrosion.
- External thermostat control allows adjustment to preferred water temperature.
- Fitted with limiting device to provide protection of overheating.
- Supplied with expansion relief valve calibrated at 6 Bar
- Wall or floor mounting
- Supplied with wall brackets.

The heaters shall be of compact design for point of use application as manufactured by ATC or equal.

The expansion vessel shall be a 2 litre expansion vessel kit as supplied by ATC or equal.



WATER TEMPERATURE CONTROL

Hot water temperature to wash hand basins, and similar sanitary equipment shall be controlled to supply a mixed hot/cold water maximum temperature of 43°C.

The temperature control valves (Blending valve) shall be installed on each of the sanitary fittings. The valve should be a Delabie Comfort 22mm with thermal shock bypass as supplied by Forde Hydrosafe. The valve shall be TMV3-8 approved.

The set temperature is to be 43°C. For system flushing a dummy blanking set shall be used.

The hot and cold water supply to each sanitary appliance shall be fitted with isolating valves.

WATER TREATMENT

Refer to General Specification.

TESTING & COMMISSIONING

Refer to General Specification.

ELEMENT 56 – SPACE HEATING

LPHW PIPE WORK

The Mechanical Contractor shall supply and install the LPHW water pipe system as shown in the drawings. The system shall comprise piping, pumps, pipe insulation, valves, measuring valves, controls and pipe supports.

The Pipe work is to be **mild steel** and insulated post installation.

Refer to General Specification also.

PIPE WORK BRACKETS

Pipe work brackets are to be of the type indicated below on the right. The brackets are to “hug” the pipe and has a rounded section to it with no horizontal protrusions at the pipe.

		
Not acceptable by DEY Note the perpendicular protrusions.	There still is the perpendicular protrusion, however, they are more rounded and less likely to cause lacerations.	This type or similar are acceptable, where the clip “hugs” the pipe and has a rounded section to it.

RADIATORS

Radiators shall be installed as shown on the drawings.

The radiators shall have heat output as listed in the equipment schedule, at a mean water temperature of 76.5°C and a room temperature 21°C, any discrepancies must be noted by the Mechanical Contractor prior to ordering. The thermal outputs shall be determined with the test methods and test programme specified by EN 552-2:1996 in a laboratory complying with EN55001.

The radiators will be as follows:

- A wall mounted panel radiator
- Panel radiator to have steel thickness of 2.0mm
- Panel radiator to have 1mm or less gap between the tubes
- Fins are to be laser welded to steel tube to ensure maximum contact with the steel tube panel
- Panel radiator to have a standard test pressure of 13 Bar with an operating pressure of 10 Bar
- Outputs are to be tested in accordance with EN14037.
- Standard RAL 9016
- Outputs over 3500watts are to automatically come with ¾" connections as standard to make sure correct flow rate is achieved to give maximum output
- Panel radiator to come with choice of connection possibilities incl. BOE, TBOE and BOE vertical from underneath

All radiators shall be capable of the outputs as indicated on schedules. The window cill heights are restricted in certain areas and should be checked by the contractor prior to ordering.

Radiators shall be supplied with all necessary joining keys, gaskets etc. as required. Radiator connections shall be Bottom-Bottom-Opposite-End. No welding seams shall be visible.

All radiators shall be supplied with thermostatic radiator valves to flow and lock-shield radiator valves to return connections.

The Mechanical Contractor shall include for pre-painting radiators to a non-standard RAL colour.

The Mechanical Contractor shall allow for samples to be provided for all radiator types to be signed off by both the Client and Consulting Engineer, prior to ordering.

TWO PORT MOTORISED VALVES

The two port valves are to be DZR brass pressure independent control valves (PICV) c/w actuator and suitable for dynamic balancing.

The valves are to confirm to the following parameters:

- They are to be treaded valves
- Be complete with a regulation cartridge for a delta pressure range of 30 – 400 kPa
- Have a tolerance on nominal regulated flow of +/- 7%
- Have an integral flow measurement device with a tolerance of +/- 3%
- Flow accuracy of +/- 5% of the max flow or +/- 10% of the set flow
- The flow modulation is to use the whole valve stroke independent of the presetting
- Be complete with a threaded M30x1.5 connection for linear actuator
- Be suitable for working conditions of -20°C to +120°C
- The valve is to be provided with test points



Actuator properties:

- Pushing force 125 N
- Fits onto valve with M30 x 1.5 thread
- With extension element 230 V, 110 V or 24 V
- Position indication in drive housing
- Can be changed from NC to NO
- Versions with built-in auxiliary contact or different cable length
- Suitable for retrofitting existing installations using an appropriate adaptor

Technical description:

- Housing made of self-extinguishing plastic, pure white as per RAL 9010
- Connection with valve using nickel-plated brass nut or plastic bayonet connector
- Connecting cable, white, standard length 1.2 m, 0.5 mm² up to 2 m or 0.75 mm² over 2m cable length
- Running time for 4.5 mm stroke: 3 min
- Installation position: vertical to horizontal, but not upside down

THERMOSTATIC RADIATOR VALVES (TRV'S)

Thermostatic radiator flow valves shall be straight or angle type each fitted with a sensor. The valves shall be fitted so that the sensor axis is horizontal. Each Radiator will be provided with a TRV on the flow and lock shield valve on the return. Where TRVs are installed, a Dynamic balance valve is to be installed on the branch serving the radiator.

TAKING DOWN OF RADIATORS

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

IDENTIFICATION AND LABELLING

Refer to General Specification.

TYPE OF PIPEWORK INSULATION

Refer to General Specification.

WATER TREATMENT

Refer to General Specification.

TESTING & COMMISSIONING

Refer to General Specification.

ELEMENT 57 - VENTILATION SERVICES

TOILET AREA EXTRACT FANS

The Toilet & Classroom Toilets are to be provided with a in line extract fans. The fans are to be complete with adjustable run on timer and provided with a speed controller for commissioning. The fans are to be controlled off a local PIR, the PIR is to be supplied by the electrical contractor.

The ducting is to be complete with back draft damper and an external weathered louver of 50% free area equating to a total louvre area twice the area of the duct supplying it.

ELEMENT 58- BUILDING MANAGEMENT SYSTEM & CONTROLS

DIGITAL THERMOSTAT

A digital thermostat is to be supplied and installed under the contract. The stat is to be supplied by the Mechanical contractor to the Electrical contractor who will wire and install the sensor.

The sensor is to be able to:

- display the temperature in the respective space
- be adjustable by +/- 2°C by the room occupants
- control the 2 -port valve(s) associated with that space

MOTORISED DIVERTING VALVES

All 2-port and 3-port control valves under 50mm should be screwed type valve. 65mm valves and over should be Flanged type

EARTHING & BONDING

Carry out earthing and bonding in accordance with ETCI requirements. Ensure all new mechanical plant and pipework is earthed and bonded as necessary.

GENERAL SPECIFICATION

WATER SYSTEM STERILISATION

A specialist sub-contractor shall be employed to clean, flush and sterilise the complete system in accordance with BSRIA AG 1/2001.1.

A bacteriological test of the system shall be undertaken after sterilization is complete.

WATER TREATMENT – DOMESTIC WATER PIPES

The water service pipe work is to be cleaned, flushed and sterilised.

The following are the principal Standards which shall apply:

- BS 6700 Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilage.
- The Water Research Centre (WRC) Water Supply Byelaws Guide.
- The Chartered Institution of Building Services Engineers Technical Memoranda TM13 - "Minimising the Risk of Legionnaire's Disease".

Requirements

Pipework Pressure Testing

- With the completion of the works or part of the works and before the application of insulation or the sealing in of pipework, the Contractor shall hydraulically test the pipework installation.
- Interim pressure tests of sections of the system shall be carried out as the work progresses, to suit the project programme. These tests shall be witnessed by the Resident Engineer or the Main Contractor's senior representative on site.
- Final pressure tests of completed sections of the system which are about to be commissioned shall be carried out and witnessed by the Engineer. The Contractor shall give at least one week's notice of these tests to the Engineer in writing.
- Certificates for each test, both interim and final, shall be completed and signed by the Contractor's senior site representative and by the witness. These original certificates shall be retained by the Contractor until completion of the works. Copies of the certificates shall be issued to the Engineer as the work progresses. On completion of the works, copies of the certificates shall be inserted into the Operation and Maintenance Manuals and the originals shall be issued to the Engineer in a separate binder.

Cleaning and Flushing

- Pipework - all new and existing water supply systems pipework within the scope of the Contract works shall, on completion of systems testing, be filled with clean cold water and flushed out in accordance with WRC Byelaw 55.

Sterilization

- On completion of flushing the system; tanks, calorifiers, cylinders, pipework and all water storage equipment; shall be sterilized.
- Sterilization shall be achieved in accordance with the procedure, chlorine concentrations and contact times set out below:

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System	Chlorine Concentration mg/litre	Contact Period Hrs.
Drinking Water	20	24
Domestic Hot and Cold Water	30	2

- Procedure - if high chlorine loss is indicated after the contact period the systems shall be flushed and re-chlorinated until a satisfactory result is achieved. The sterilizing of water shall be disposed of in compliance with the requirement of the Water Supply Authority. Following successful chlorination, the systems shall be drained and refilled with clean mains water.
- The sterilization shall be carried out by specialist technicians qualified and experienced in this type of work. Protective clothing and goggles shall be worn by the operatives carrying out this work.
- The Operating and Maintenance Manual shall include a section on precautions to avoid the growth of Legionella in the water systems. The relevant recommendations in the Chartered Institution of Building Services Engineers Technical Memorandum, TM13, shall be included.

IDENTIFICATION AND LABELLING

The Contractor shall allow for labelling of Existing LPHW distribution pipework within boiler room.

The following are the principal Standards which shall apply:

- BS 1710 Specification for identification of pipelines and services.
- BS 4781 Specification for self-adhesive plastic labels for permanent use.
- BS 5378 Safety signs and colours.
- BS 5499 Fire safety signs, notices and graphic symbols.

Products

Identification labels materials shall be as follows:

- Pipework - Cadmium Free Vinyl Film at 85 microns thick and 275mm tall.
- Pipework Ancillaries - Traffolite laminated tags
- Plant:
 - Indoors - Rigid PVC or laminated traffolite
 - Outdoors - Polycarbonate sheet

All pipe work ID banding is to be exterior grade to BS1710 and BS4800 standards. The tape is to be made of durable PVC base material with a permanent acrylic adhesive backing, combined with a UV filtered PVC overlay It should have good resistance to water, oil and chemicals with a service temperature range of -20 to +80° C.

Labels shall be purpose made and printed with lettering height at least 15mm. high. Lettering on tags shall be at least 6mm. high.

Sample drawings of the proposed labels shall be submitted to the Engineer for approval prior to ordering.

Self-adhesive labels shall be fixed to a cleaned surface to ensure proper adhesion.

Plant labels shall be fixed by means of screws at regular intervals.

All labels shall be fitted in a position where they can be easily seen during normal maintenance.

Pipework Labelling to be by Pipemark or equal and approved.

TYPE OF PIPEWORK INSULATION

Pipe work insulation type is to be as follows:

Pipe Work Location	Insulation Type
At High Level - Exposed	Fibreglass insulation c/w aluminium foil finish
At High Level - Concealed	Fibreglass insulation c/w aluminium foil finish
At an Accessible level - subject to damage (excluding plant rooms)	Thermoclad Insulation
At low level - subject to damage	None (unless otherwise stated)
Within Plant Areas	Thermoclad Insulation
Within Wet Rooms	Thermoclad Insulation
Externally	Thermoclad Insulation

Thermal insulation shall be applied to:

- All concealed pipework. (including stub partitions and between floors)
- All external pipe work.
- Feed water tanks likely to be subject to frost damage.

Insulation shall be neatly trimmed and swaged off at all manholes, covers connections, flanges, bosses etc. Finishes shall be carried past the ends of the fibreglass and firmly stuck to the metal.

All flanges and valves of 65mm. bore and over shall be lagged in conformity with the pipework in which they are located and provided with proprietary insulation jackets or boxes (located externally)

All insulation and finishes shall be arranged in an approved manner to permit the easy access to and removal of flange bolts, manholes, test points, instruments etc.

Insulation shall not be applied before the Engineer's acceptance of the specified pressure tests.

Thermoclad Insulation:

Refer to table of "Type Of Pipe Work Insulation" for locations of installation.

All insulation work will be performed by thermal insulation specialist Contractors. It is the Mechanical Contractor's responsibility to finish and install the shoes required for insulated lines passing over steel supports.

The following are the principal Standards which shall apply:

- BS874 Parts 1, 2 & 3. Methods for determining thermal insulating properties

All work shall conform with all Government, Local Authority, Fire Officers and other Municipal Authority regulations, bye-laws and other requirements.

The thermal insulation shall not be applied until the pipework installation has been tested.

Insulation materials and finishes shall be inherently proof against rotting, mould and fungal growth and attack by

vermin, be non-hygrosopic and in all respects be suitable for continuous use throughout the range of operating temperatures and within the environment indicated.

Any work not of acceptable standard shall be removed and replaced at no cost to the contract.

All insulation materials and finishes shall be installed in accordance with the manufacturer's recommendations.

No insulation material containing CFC or HCFC components shall be accepted.

Unless otherwise indicated, the following services shall be thermally insulated and also vapour sealed where noted:

1. chilled water and refrigeration pipework insulated and vapour sealed;
2. low and medium temperature hot water insulated to suit temperatures;
3. hot water services (non-domestic) insulated to suit temperatures;
4. cold water services (non-domestic) insulated and vapour sealed;
5. steam, condensate and high temperature hot water insulated to suit temperature; and
6. pipework exposed on roof or other external locations, unless otherwise indicated, insulation will be as above with weatherproof finish, and in the case of services a and d with electric trace heating

Pipework Systems up to 120°C

1. Insulation shall be Thermobreak Foam pipework insulation or equal & approved.
2. The aged thermal conductivity of the insulant shall not exceed 0.033 W/m K at 10°C mean.
3. The insulation shall be Class 0 / Low Risk rated to the Building Regulations / Standards. The bore face of sections shall be de-dusted and coated with a non-odorous passivating solution after manufacture.
4. Insulation thickness is to be determined in accordance with the BS 5422: 2009.
5. All pipe support inserts on pipework operating up to 120°C shall be rigid phenolic insulation, Kooltherm Insulated Pipe Support Inserts, or equal and approved.

Fibreglass Insulation:

Refer to table of "Type Of Pipe Work Insulation" for locations of installation.

Fibreglass insulation shall be finished with aluminium foil to Class 'O' flame spread specification. Overlaps shall be allowed on the foil to create a continuous vapour proof surface finish. The overlaps shall be jointed by means of an adhesive, approved and in accordance with the manufacturers recommendations.

Fibreglass insulation on calorifiers and other vessels and flat surfaces shall be secured by means of 25mm mesh x 20 s.w.g. galvanised wire netting. The wire netting shall be tied to lugs affixed to the surface of the equipment or secured in other approved manner and finished with 18 s.w.g. aluminium cladding jacket.

Armaflex Insulation:

Armaflex shall be to Class 'O' flame spread specification and sections shall be jointed and fixed by means of an adhesive, approved and in accordance with the manufacturers' recommendations. The surface of the insulation shall not be distorted by the incorrect application of tapes or tags. The Contractor shall ensure that the jointing provides a continuous vapour proof surface finish. At brackets, the vapour barrier shall be maintained by jointing the Armaflex to the metal sleeve with PVC tape. The maximum conductivity shall be 0.033 (W/mK) minimum thickness shall be 13mm.

INSULATION JACKETS

Insulation jackets are to be installed on ALL items as listed below.

The insulation jackets are to be supplied & Installed as follows:

- Bath Cloth - Silicone Grey Rubber Coated Glass Cloth, Style 8590SR148
- Fabric weight - (480 grms/M²)
- Fabric Thickness - (0.40 mm)

- Temperature Resistance - for continuous uses up to 220 °C
- Mineral infill - 50 mm fabricated in one piece, complete with quilting pins. Where multiple pieces are required, joints are to be staggered.
- Draw Cords are to be provided at top & bottom.
- Velcro secured closure
- Overlaps to be 65mm

All covers are to be made to measure with sewn edges and conform to the configuration of the item being insulated.

The jackets are to include openings for all protrusions such as pipes, control valves and gauges.

The jackets are to be installed on the following items:

- Flanges,
- Gate Valves,
- Screw Valves,
- Strainers,
- Control Valves,
- 3-way Valves,
- Calorifier Manifolds,
- Plate Heat Exchangers,
- Header Ends.

The jackets are to be supplied by GEM Utilites Ltd or equal & approved.

TESTING & COMMISSIONING

Testing and commissioning shall be carried out as per below and the enclosed testing and commissioning scope of works.

Pressure Testing

The pressure test shall not include any item which is not designed to withstand the test pressure. In addition, the following items are not to be included: safety valves, pressure gauges, in-line instruments, filters, expansion joints, flexible hoses, machinery such as exchangers compressors, pumps, vessels and heaters. The Mechanical Contractor shall remove or block these items out prior to test. The Mechanical Contractor shall include for supply and fitting of flanges where required for testing sections of the piping. The positions where these flanges are required will be agreed between the Engineer and the Mechanical Contractor.

Pressure and Temperature In-Line Test Plugs

The Mechanical Contractor shall supply and install "Binder" Twinlock Test Plugs in the positions shown on the drawings. Test plugs shall be inserted in 1/4" BSP Sockets welded to pipe lines, and shall be complete with removable cap, cap retaining strap, insertion guide, twin cores in series to retain full pressure and fluid seal.

Test plugs shall be PAT No. 138386. Brass body with a Nordel Core for all water application. Temperature gauges for use with Twinlock Test Plugs shall be "Binder" type C100 with a temperature range of 0°C - 140°C.

Pressure gauges for use with "Binder" Twin lock test plugs shall be type B 100 with type B 180 adaptive probe, with pressure range of 0-140 psi gauge.

Permanent In-Line Thermometers and Pressure Gauges

The Mechanical Contractor shall supply and install pressure gauges, and thermometers in the positions shown on the drawings. Permanent pressure gauges and thermometers shall be confined to positions at heat exchangers, suction and delivery of all pumps and pressure vessels.

Fluids for Testing

All piping shall be tested hydrostatically by the Mechanical Contractor utilising clean water.

Any equipment or materials necessary for testing the piping systems shall be supplied by the Mechanical Contractor. This includes certified test pressure gauges and test safety valves. All hydraulically tested piping is to be flushed clean of all testing fluid before filling with the working fluid.

Test Pressure

The test pressure to be used for the various circuits shall be as specified or in general at 150% of the working pressure of the circuit. A minimum of 5 bar unless otherwise specified shall be applied to all mild steel lines and copper water service lines.

Preparation for Testing

The Mechanical Contractor, together with the Owners representative, will make a visual inspection of the system to be tested. The inspection shall satisfy the owners representative that the system is installed in accordance with specification and drawings. All deficiencies shall be corrected by the Mechanical Contractor before testing.

The Mechanical Contractor shall expose all flanges, threaded and welded joints. No painting or insulation shall be done until after test acceptance. The Mechanical Contractor shall locate the source of test pressure for a circuit upstream of any check valves. The Mechanical Contractor shall set control valves in the open position unless otherwise directed. The Mechanical Contractor shall, if hydrostatically testing a line supported on springs, block the spring if necessary to support the liquid load. The Mechanical Contractor shall check all flanged joints to see the bolting, gaskets and ratings conform to the piping material class.

Blow Out

Prior to pressure testing, the Mechanical Contractor shall blow out all piping to remove any possible accumulation of foreign material.

Acceptance

All testing shall be witnessed by the Client's representative. A log of all lines tested shall be maintained by the Mechanical Contractor. Both the Mechanical Contractor and the Client's representative shall date and sign the test log as the various tests are completed. Upon completion of the work, the Mechanical Contractor shall supply the Owner representative with a certified copy of the test report.

Retests

Any leaks or defects found during the testing are to be repaired and the lines re-tested to the originally specified test pressure at the Mechanical Contractor's expense.

Completion

After testing, the Mechanical Contractor shall replace any items which were removed, and remove all blanks and blinds, making sure that they are all accounted for.

Hydrostatic Testing

The Mechanical Contractor shall install test gauges. Readings may be taken at low points of the system, however the static head must be added to the specified test pressure. The Mechanical Contractor shall make a visual check of all joints for gross error or omissions. The Mechanical Contractor shall fill the system with water, taking care to eliminate all air pockets by keeping vents open until water flows from them. The Mechanical Contractor is responsible for checking the pipe systems for vents and drains and providing all vents where required.

It is mandatory that all parts of the system can be completely drained. The Mechanical Contractor shall pressurise the system to the specified test pressure. The test shall be considered satisfactory if no leakage is discovered on the piping or at any joints, or if no excessive sweating due to porosity is discovered on piping or joints. The test pressure shall be maintained long enough for a thorough examination of all joints, but no less than 2 hours. The Mechanical Contractor shall not allow lines and equipment to stand full of water without venting except during the actual test period.

After completion of tests the Mechanical Contractor shall drain the system completely and purge with dry air to remove all water and to prevent damage due to freezing. The Mechanical Contractor shall ensure the vents are open when withdrawing the test medium from any vessels which may be involved.

If water is being used for testing and the possibility of damage due to freezing exists, then another suitable liquid may be used.

All hydraulic tested pipework is to be flushed clean after testing until the flushing water runs clean. All meshes in pipe line strainers are to be removed after flushing and are only to be refitted after cleaning. Systems should then be re-filled and flushed with clean water until the system runs clear to the satisfaction of the Engineers. The Engineer should be notified a minimum of 48 hours before such final flush is to commence.

Pneumatic Testing

The Mechanical Contractor shall install test gauges and test safety valves, make a visual check of all joints for gross error or omissions, gradually bring the pressure up to the lesser of 1.5 bar gauge, or 25 per cent of the test pressure and make a soap suds test of all welds and connections at this point. If the system is satisfactory the Mechanical Contractor shall gradually increase the pressure in incremental stages of about 10 per cent of the test pressure for two hours, inspect all joints for leaks with soap and suds test, and continuously monitor the pressure gauge for loss of pressure. Safety of personnel is of prime importance during pneumatic testing.

Witnessing

Testing shall be witnessed by the Engineer or the Engineer's authorised representative.

Commissioning

The whole of the Mechanical Services installation shall be balanced and commissioned after testing. The Mechanical Contractor shall commission all water services systems in accordance with the recommendations of the CIBSE Commissioning Code.

It shall be the Contractors responsibility to adjust the system; valves, controls, etc, to achieve the design conditions.

FIRE SEALING

All services penetration fire rated structure shall be sealed to comply with statutory regulations

LPHW PIPE WORK

The Mechanical Contractor shall supply and install the LPHW water pipe system as shown in the drawings. The system shall comprise piping, pumps, pipe insulation, valves, measuring valves, controls and pipe supports.

The pipework shall be Mild Steel Pipe work.

The overall scope of work includes the supply, fabrication and testing of above ground piping systems, the installation of instruments detectors, control valves, and the supply and erection of all field installed pipe supports. All work shall be performed in strict accordance with drawings and this specification.

Before installations are commissioned and subjected to the required tests the systems shall be thoroughly cleaned internally and externally.

Arrangements to ensure cleanliness of systems shall follow the recommendations of the relevant codes and where indicated chemical cleaning of water systems shall be carried out as required by the Contractor

Codes

All codes specified in this specification pertaining to this work shall be observed by the Mechanical Contractor. The fabrication and erection of the piping systems shall be in accordance with the code for pressure piping ANSI B31.3. In the event that local codes or safety orders are more stringent than ANSI B31.3, the local regulations shall govern.

Materials

All materials shall be of high quality, new, free of defects, of Irish/British manufacture where practicable and of type and grade specified in the piping material specification or on the drawings. Substitution of equals may only be made after approval of the Engineers.

Workmanship

The Mechanical Contractor shall employ only labour which has been qualified by training and experience to capably perform the specific activities required to accomplish the work in satisfactory manner.

Equipment

The Mechanical Contractor shall provide and maintain all tools, and equipment in first class condition and in sufficient quantities to assure successful performance and completion of the required work.

Installation

During installation, the Mechanical Contractor shall be responsible for avoiding any and all possible interference with the work of other trades.

Pipe Fabrication and Erection

Cutting of work in place shall be kept to a minimum, with the Mechanical Contractor anticipating conditions required for the installation of his work and furnishing the other trades with proper instructions. Cutting required shall be carried out by the Mechanical Contractor.

Repair or replacement of damaged material or equipment shall be done by the Mechanical Contractor. Cost of cutting and/or repair work shall be assumed by the Mechanical Contractor as part of his general work. No additional charges shall be made to the Owner.

Pipe and fittings shall be accurately cut to measurements established at the site, and shall be worked into place without springing or forcing, clearing all openings and equipment. Pipe, valves and fittings shall be kept a sufficient distance from other work to permit finish painting. Changes in sizes shall be made with appropriate reducing fittings. Piping shall be level and plumb and parallel to building walls.

Pipe shall be cut with an approved wheel type of mechanical cutter. Pipe deburred and reamed after cutting.

Connections

Connections shall be made as specified in the ANSI B31.3 code for pressure piping Fig 325.3 1A. Machined bevels are preferred for all materials. If machining is not practical, carbon steel may be bevelled by grinding or flame cutting and grinding. During all phases of construction, all pipe ends, shall remain sealed, except when pipe joint closures are being made.

Welding Procedures

The Mechanical Contractor shall submit to the Owner for approval, prior to fabrication, his welding procedures for all materials and locations and positions where welding operations are to performed. Certain specific requirements are noted in the following paragraphs.

General

The preparation and procedure for welding shall be in accordance with ANSI B31.3 Code for pressure piping.

Carbon Steel

Carbon steel welding shall be performed by the shield metal arc process. Welding electrodes shall conform to ASTM A233, Class E6010, E6016, and E5016.

Welder Qualifications

Welder performance qualifications shall be in strict accordance with Section IX of the ASME Boiler and Pressure Vessel Code using qualified procedures. The Mechanical Contractor shall keep on file, at his office on the jobsite, each operator's certificate of qualification. This certificate shall be made available to the Engineer's or Client's representative at his request. Particular emphasis to be placed with regard to Operator's Certificate for Stainless Steel work.

Threaded Joints

Threads shall be full, true taper and accurate to gauge and shall conform to BS 21. Reducing fittings shall be used rather than threaded bushings for size reduction. Joints to be sealed by use of PTFE tape or suitable compound as service dictates

Flanged Joints

Flange ratings and facings, bolts, and gaskets shall be in accordance with BS 10. Bolts shall be uniformly tightened. Extreme care is to be used in bolting together flanges to ensure no misalignment occurs and that the gap between them is a minimum sufficient only to fit the appropriate gaskets. Extreme care is also to be used in protecting and handling flanges so that the facings are not nicked or scratched.

Springing of flanges into position is prohibited.

Fittings

Buttweld elbows shall be long radius unless noted on the drawings or per piping material clauses. Screwed Connections. All screwed connections to be to BSP unless shown otherwise on piping drawings.

Pipe Branch Connections

Any line taken off a main line, except vents, drains and instrument connections, is considered a branch line. Branch connections shall be made by the use of tees, reducing outlet tees, Socklets or threadlets, weldlets or stub-ins. In general, buttweld tees shall be used in all sizes greater than 50mm, up to header size unless noted otherwise in the material clauses of the specification. All stub-ins under 50mm shall be made, and reinforced if necessary, in accordance with the requirements of the ANSI Code for Pressure Piping. Socklets or threadlets as specified shall be used for branch connections 50mm and smaller.

Valves

Valves may be supplied with non-metallic seals. Extreme care must be used when welding adjacent to these valves in the piping so as not to damage the seals. The bonnet and stem assemblies shall be removed prior to welding, taking care to preserve cleanliness, and then re-assembled. Minimum possible heat should be transmitted into the valve bodies to prevent distortion.

Supports

"T" supports for heat insulated lines and dummy-welded supports shall be shop welded to pipespools when shop fabrication of spools is permitted by the Engineer.

Soldered Joints

All soldered joints shall be made in accordance with BS 219 solder grade 95A and 96S. Tube ends shall be square cut and reamed, straightened and rounded with straightening tools as necessary. Fittings and tube surfaces shall be properly cleaned with steel wool or sandpaper and a suitable flux shall be used in accordance with manufacturer's recommendations.

Apply uniform heat with blow torch or oxyacetylene torch. Adequate cooling time shall be allowed before washing or quenching.

Appurtenances that are fragile or heat sensitive shall be protected against overheating or the sensitive parts shall be removed during this application of heat.

Reference to soldered joints to BS 219 grade 95A and 96S herein indicates a filler metal as specified for specific surface and requiring melting temperatures approximately as follows:

- All solder used shall be lead free.
- Solder Grade 95A Tin/antimony melting point 236°C
- Solder Grade 96S Tin/silver melting point 221°C.

Flanged Equipment

Flanged equipment connections shall be kept covered until ready to connect the piping. When connecting flanges to equipment such as compressors, exchangers and pumps, care should be taken to ensure close parallel and lateral alignment.

Flanges

Use flat-face flanges with full-faced gaskets against flat-face valves of equipment faces. Provide flanges only at flanged equipment connections, valves and for blinding off connected equipment which is not flanged.

Fittings

Buttweld elbows are to be long radius (1½ diameter); short radius elbows (1 diameter) to be used only where absolutely necessary. Reducing elbows may be used where space limitations or flow conditions dictate their use. Eccentric reducers shall be bottom flat in services that require no pockets.

Reductions

Make reductions in lines with welding reducers.

End Closures

Install the piping to avoid dead ends where no future expansion is contemplated. Where the future extension is anticipated or clean-out is necessary, close the line with a blind flange. Threaded plugs or caps shall be used for threaded-end closures. Should a dead-end be unavoidable, close end the weld cap, except for slurry lines which shall be terminated with a blind flange.

Equipment Isolation Valves

Valves not considered as operating valves are branch line block valves from a main header, blocks and bypasses on control valves, level control valves, level gauge valves, battery limit block valves and block valves on exchangers and coolers. Operating valves are placed when possible so they can be operated and serviced from grade, access platform or ladder. Do not install valves with their stem lower than a horizontal position or projecting into Passageways. Locate manually-operated throttling valves near their respective flow indicators.

Check Valves

The preferred location for ball-check and swing-check valves is in horizontal pipe runs. When installed in the vertical, provide a drain above the valve. Install lift-check valves in horizontal runs only. The wafer, disc type, check valve may be installed in either position. Locate check valves on pumps between pump discharge flange and shut off valve.

Control Valves

The drawings show the location of all control valves and any block or bypass valves in the control valve manifold.

Locate control valve manifolds at grade or on operating platforms. Place level control valves in sight of the level indicator. Place local-mounted indicators or controllers in sight of the control valve wherever possible to facilitate instrument reading.

Install control valves with the stem vertical, install a short spool on each side between the control valve and the block valves - if block valves are required. Allow for sufficient clearance above the valve to remove the top works.

Where the block valves are smaller than line size, make the reduction immediately adjacent to the block valves using swages, welding reducers or reducing elbows.

Relief Valves

Relief valves shall be installed in an upright position and in a location accessible from a platform or grade. Where possible mount vessel relief valves as close as possible to the vessel or header. Relief valve piping that discharges into the atmosphere shall discharge vertically 3000mm above any platform or ladder within a radius of 2600mm of the valve. Pipe the atmospheric discharge from relief valves discharging any liquid to the nearest appropriate drain. Provide a 15mm drain to prevent an accumulation of liquid in valve stacks open to atmosphere. Cut tail pipe ends 30° measured from the pipe centreline.

Pumps

Suction lines should be kept as short as possible and routed so as not to create vapour pockets. Use eccentric reducers for any line size reduction in horizontal runs. Provide a removable spool with a temporary strainer between the suction block valve and the pump inlet. Provide sufficient support for the piping so that as little of the weight of valves and piping as possible is transmitted to the pump casing. Valve hand-wheels should be orientated so that they do not block aisles or project back over the pump or motor.

Install removable pipespools between the block valves and the pumps or drivers. End suction pumps should have the suction piping arranged so that the impeller may be removed while the suction block valve is in place. Whenever possible, locate the valves in the pump piping so they are accessible for hand operation. Where pump discharge piping goes to an overhead pipeway or overhead equipment, install the block and check valves in the vertical piping above the pump.

Instrumentation

The scope of work for this specification is to include the installation of all in-line instruments such as valves, thermostats and sensing devices. The Mechanical Contractor shall also be responsible for the installation of all piping and materials up to and including pressure activated instruments such as pressure gauges

Temporary Strainers

The Mechanical Contractor shall install temporary strainers or screens to protect pumps and in-line equipment during commissioning and remove and make good any joints after proof testing as directed. Strainer screens shall be removed and washed down after flushing of the piping.

Protection

All open ends of piping shall be closed with approved plugs or caps as soon as erected. All piping having finished, chrome plated or similar surfaces polished, shall be carefully covered to protect the finish against damage.

Open ends of below ground piping terminating above ground, shall be protected with plastic covers.

Flanges of below ground piping terminating above ground shall be closed with a wooden cover secured with 2 bolts, (180° apart), minimum of 300mm above high point finished grade.

All plastic or other similar pipe shall be protected from:-

- Walking thereon
- Welding sparks
- Or any other form of possible damage.