

**Coimisineir Teanga
An Spideál
Co. na Gaillimhe**

**GENERAL MECHANICAL SPECIFICATION
UNG-CT-GMS-1**

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GENERAL TECHNICAL SPECIFICATION

1.0 GENERAL

The intention of this specification and the drawings issued is to describe and provide for a complete installation. The Contractor is advised that the work to be executed as described in these documents shall be complete in every detail, notwithstanding that every item involved may not be specifically mentioned or described. The Contractor shall be held to allow for all materials and labour necessary for an entire and complete installation and shall not avail of any unmentioned error or omission should such exist.

1.01 PIPEWORK

All LPHW Space Heating pipework in the boiler house shall be carried out in medium gauge (Class B) mild steel tubing complying with BS EN 10255:2004 with welded joints.

At dismantling joints on pipework or where pipework is connected to an appliance, all joints shall be flanged. Flanged joints shall be by wrought iron or annealed steel flanges machined full face screwed or welded to the pipe. Joints between flanges shall be made with approved copper-nickel rings and jointing compound. Bolts shall not be allowed to protrude from the nuts by more than 7 mm and shall be ordered to the correct length.

The utmost care shall be exercised to ensure that adjoining metals are compatible and do not give rise to electrolytic corrosion. For example, where galvanized piping is joined to stainless steel, copper or iron, a brass bush or flange shall be used to ensure that no contact takes place between the metals. In particular, care should be exercised where copper and galvanized steel are used adjacent to each other.

1.02 INSULATION OF PIPEWORK

All insulation shall comply with the requirements of BS 1334 and 1588. Surfaces to be lagged shall be thoroughly cleaned and free from grease, oil, dirt and foreign matter.

Pipework to be insulated is indicated on the drawings and all insulation shall be of rigid glass wool sections or flexible foamed plastic pipe insulation as manufactured by ARMAFLEX, carried over brackets to the thickness as later specified. Each run of piping shall be insulated separately.

At bends and branches, the insulation shall be close mitred, joined with adhesive or packed with loose wool in all gaps and surfaced evenly with china clay paste.

No insulation shall be applied until all pipework is hydraulically tested and passed as satisfactory to the Engineers.

All hot pipework throughout the installation shall be insulated according to the following thickness:

- a) For pipes up to 40mm outside diameter the thickness of insulation to be equal to the pipe diameter.
- b) For pipes over 40mm outside diameter the thickness of insulation to be at least equal to 40mm.

All cold pipework located in the attic space, at high level or anywhere there is a risk of condensation or freezing occurring shall be insulated to 13 mm thickness of insulation.

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1.03 IDENTIFICATION OF PIPEWORK

All pipework shall be labeled with colour codes in accordance with CIBSE, codes clearly indicating fluid being carried and the direction flow.

2.0 SPACE HEATING INSTALLATION

2.01 RADIATORS

Radiators are to be rigidly supported on steel brackets supplied by the radiator manufacturer. These shall be fitted to the back and bottom of the radiator with a tap at the top and shall generally concealed from view. Radiators shall have a clear space of 40mm between the back of the radiator and the wall, and 150mm between the bottom of the radiator and the finished floor level. Except in the case of some window radiators, no radiator shall stand above the level of the window board, and before ordering radiators, the Contractor shall measure up on site and confirm to the Engineer that radiators selected are suitable in all respects.

All radiators shall be provided with an approved key operated air vent. All keys shall be interchangeable.

The plastic covering the radiator shall not be removed until after commissioning.

Pipe work connections to radiators shall be made so that stress is not transmitted to the radiators from expanding or contracting main pipe work. Radiators shall be slightly graded to air vents, which shall be fitted on the return end of the radiator.

Vents shall be of the flush mounted and key operated type.

All radiators shall be in perfect condition and appearance when erected. The Contractor shall allow for taking down and re-fixing once only, to facilitate other trades. The Contractor is advised to delay final fixing of radiators as long as is possible in order to diminish possibility of damage and to eliminate taking down and re-fixing more than once. Unless given prior permission by the Consulting Engineers no extra cost will be allowed for taking down and re-fixing more than once to facilitate the Contractor or other trades.

2.02 CONTROL VALVES FOR RADIATORS

Each radiator shall be fitted with control valves to control the water flow so as to maintain the selected temperature whilst maintaining effective hydraulic balance in the system, unless otherwise indicated. Valves should have a built in temperature sensor and care shall be taken in their installation to ensure that they are fitted so that the sensor is not subject to undue heat gain from distribution pipes or other heat sources which may interfere with its operation.

2.03 LOCKSHIELD VALVES FOR RADIATORS

Lock shield valves shall be of the double regulating type with characterized plugs and lockable indicator on the spindle enabling the setting to be locked and maintained even when the valve is used for isolation purposes. Lock shield valves shall have easy clean enclosures. Two loose keys shall be supplied for each size and spindle.

2.04 PIPEWORK ERECTION

The arrangement of all pipe work on site shall be agreed with the Engineers.

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All work must conform to the byelaws, regulations and requirements of the various Government and Local Government Authorities.

Pipe work shall be neatly installed and graded so as to allow for venting and drainage and shall be fitted so as to rest properly on supports at all times. Careful consideration shall be given to the location of all fittings, welds etc.

Particular care shall be taken to ensure that no air locking occurs with L.P.H.W. pipe work.

Any pipe work run at surface level shall generally be clear of walls by 50mm and clear of floors by 100mm.

A clearance of 150mm shall be maintained between pipe work and any part of the electrical installation.

No sharp elbows shall be allowed and all bends and sets shall be of the largest radius possible, set from the piping in such a manner so that no change of area occurs in any part of the bend.

Prior to or during installation open ends of pipe work shall be protected from the ingress of dirt. Timber, plastic or metal plugs shall be used for this purpose. The Contractor shall be responsible for rectifying any stoppage, which may develop due to dirt or rubbish.

Before the commissioning of any pipe work installation, the pipe work and any associated equipment shall be cleansed of any accumulated dirt or rubbish by washing out or blowing through twice.

Particular care shall be taken of the spacing between pipes when setting out to ensure that due consideration has been taken of insulation thickness to be applied and its effect on the neatness of the finished installation.

Pipe work cut to size on site shall have the ends reamed out to retain full bore and to remove all burrs.

Joints shall not be positioned in the thickness of any wall, floor or ceiling. All piping shall be cut to accurate measurements established on site and shall be worked into place without any forcing or springing. All pipe work shall be run concealed whenever possible.

2.05 PIPEWORK SUPPORTS

Exposed pipe work in rooms shall be supported on allowable iron or brass split pattern screw-to-wall school board type brackets, depending on the service. The Contractor shall allow for lining up the brackets, fixing the brackets and drilling and plugging the walls. Brass screws to be used with brass brackets and screws to have a minimum length of 50mm. Plastic type wall plugs to suit the screw size shall be used.

Pipe work run above suspended ceiling shall be fixed by adjustable hanger or brackets as BOSS Flamco or similar approved.

Exceptional care shall be exercised when supporting and bracing pipe work to ensure that no hammering or vibration takes place and that the complete system operates in a quiet manner even when valves are closed off quickly against full pressure.

Where pipe work is installed, brackets shall be dimensioned and mounted so as to accommodate the insulation 15mm clear of the surface wall. Brackets shall allow for thermal expansion and ample clearance to be allowed when setting out brackets for large pipes. Supports shall be arranged to be as near as possible to changes in direction and joints.

Where pipe work is exposed the Engineers approval shall be obtained as to the location and method of fixing of pipe supports before putting the work in hand, to ensure the required standard of neatness is achieved. Where floor level pipes are likely to be subjected to abuse additional floor type brackets shall be used in locations to be decided by the Engineer. They shall comprise a split pipe ring, pipe nipple and back plate secured to the floor.

Brackets, which have to be secured to structural steelwork, shall be fixed with special girder clips. Welding or drilling the steelwork will not be carried out without the permission of the Structural Engineer.

All adjacent pipe work following the same route shall be bracketed at the intervals specified for the smallest pipe in the run. The following are the bracket intervals depending on the material of pipe work:

STEEL PIPE BRACKET INTERVALS BORE (mm)	HORIZONTAL (m)	VERTICAL (m)
15	1.5	1.8
20	1.5	2.1
25	1.8	3.0
32	1.8	3.0
40	2.4	3.0
50	2.4	3.5
65	2.7	4.0
80	3.0	4.0
100	3.0	4.6
125	3.7	5.5
150	4.5	5.5

COPPER PIPE BRACKET INTERVALS BORE (mm)	HORIZONTAL (m)	VERTICAL (m)
15	0.9	1.2
22	1.2	1.5
28	1.5	1.5
35	1.5	2.0
42	1.8	2.4
54	1.8	3.0
65	2.4	3.7
76	2.4	3.7
108	2.4	3.7
133	3.0	3.7
159	3.7	3.7

2.06 PIPEWORK SLEEVES

Pipe sleeves of appropriate diameter and of the same material as the pipe shall be fitted where pipes are installed through walls, duct covers, ceilings and floors.

Sleeves shall be round out and free from burrs and project 5mm on either side of finished wall surfaces.

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

Where it is not practical to fix pipe sleeves the Contractor shall make sure that a hole of sufficient diameter is allowed to enable the pipe work freedom of movement. This may necessitate the pipe being wrapped in a non-combustible, flexible material.

Adequate allowance shall be made for thermal expansion. Pipes passing through sleeves shall be positioned to allow for this movement. The sleeves shall be arranged to finish flush with the plaster or other wall finish and be of one length.

The following table shall be used as a guide for the size of sleeves.

PIPE BORE (mm)	BORE OF SLEEVE (mm)
15	25
22	32
28	38
35	41
42	51
54	63

2.07 PROVISION FOR ANCHORING, GUIDANCE AND EXPANSION OF PIPEWORK

Pipe work shall be laid out and fixed so that as much of the thermal expansion as possible can be taken up within the system. Where this is not possible, expansion loops or other approved type of expansion compensators shall be used.

Where and if anchoring or guidance is required for the pipe work run at high level above the false ceiling, a frame fabricated from mild steel channel and angle shall be provided with struts welded to the frame and rag bolted to the concrete floor above, to resist such horizontal movements as may be exerted on the anchorage from expansion forces.

Particular care shall be exercised in mounting or fixing pipe supports near expansion loops to ensure the correct degree and direction of movement is taken up by the expansion device.

2.08 TAPPINGS IN PIPEWORK

Provision shall be made for suitable tappings in pipe work or mountings for gauges, thermostats, and detectors etc. It should be note that these items may require positioning in bends, elbows etc. as appropriate. Manufacturers instructions shall be consulted.

2.09 VALVES AND INSTALLATION

Isolating and regulating valves shall be provided on each circuit as shown on the drawings. Isolating valves shall be the full way gate type. Regulating valves shall be of a suitable type to allow correct balancing of the system.

The Engineers permission should be sought prior to ordering valves. During installation valves shall be kept closed and care taken that valves are not distorted under pressure on spanner tightening or that the tube connection is not forced home. Jointing compound shall only be applied to tube and NOT the valve thread.

Valves shall be removed from line before adjacent welding is carried out.

Misaligned, distorted or leaking valves shall be reseated, repacked or replaced at the Contractors own expense.

2.10 WALL AND FLOOR PLATES

Wall and floor plates if required shall be installed on all pipes, which are installed in exposed positions through floors and walls. They shall be of setscrew pattern zinc alloy die-castings type with chromium-plated finish or similar approved.

2.11 PROVISION OF AIR VENTING AND DRAINAGE

Provision shall be made for venting of air and drainage of pipe work where required and where shown on the drawings.

Devices for air venting shall be provided at all high points in the system. Normal provision shall be for an equal tee installed with the branch upwards and an extension piece 150mm long of the same bore as the pipe being vented but not less than 20mm bore and not greater than 50mm bore to form air pocket, the top of the extension piece being plugged and fitted with an 8mm bore needle-sealed

key operated air cock. Where access to this air cock is difficult an 8mm bore extension tube shall be run to a suitable position to be agreed with the Engineer.

Where special provision is required, a larger air bottle shall be provided when so indicated on the drawings or requested by the Engineer. Larger air bottles shall be formed of an extension piece 200mm long.

Drainage shall be provided at all low points of the system and where indicated on the drawings. Drain cocks shall be 15mm bore, key operated, with a hose union.

2.12 TESTING

After the installation is complete but before the insulation is applied, the pipe work and valves shall be hydraulically tested to 7 bar (100 psig) and shall remain drop tight at that pressure for a period of eight hours. Radiators and thermostatic radiator valves shall be disconnected during the hydraulic test and open ends capped.

All welds shall be hammer tested while under pressure. Should any leakage occur, the Contractor shall make good at his own expense, notwithstanding that previous tests may have been satisfactory. If necessary the Contractor shall test the system in sections and no extra shall be allowed on this account.

After a satisfactory test under cold water pressure, and once the insulation has been applied, the valves connecting the heating mains shall be opened up and the system shall be operated to ascertain that circulation is satisfactory and that the system is ready for commissioning. The Contractor shall be held responsible for the satisfactory operation of the system and for defects arising from faulty materials and workmanship.

3.0 BOILER PLANT

3.01 PIPEWORK AND FITTINGS

Pipe work and fittings complying with the requirements as previously set out in the section dealing with 'Space Heating Installation': section 2.0.

3.02 RUN OF PIPEWORK

Particular care shall be exercised in the arrangement proposed and in the fabrication of pipe work in the Boiler Room to provide a neat and logical arrangement so that the effect of operation of all valves and control devices is clear and obvious. Valves with related functions shall, as far as possible, be arranged at similar levels.

Particular care shall also be devoted to the spacing of pipe work, particularly that which is to be insulated, and due account taken of the dimensions of all valves, inline circulators, control devices etc., to be inserted in the pipe run, as well as the thickness of insulation, so that the desired orderliness of the finished insulation is achieved.

3.03 TEST POINTS AND INSTRUMENTATION

The Contractor shall allow for providing adequate test points for flue gas analysis and for temperature.

3.04 INSULATION

All hot and cold pipe work in the boiler room shall be insulated. Valves shall not be insulated, and insulation shall terminate at each valve in a neat and workmanlike manner.

3.05 TESTING

After the installation is complete but before the insulation is applied, the pipe work and valves shall be hydraulically tested to 7 bar (105 psig) and shall remain drop tight at that pressure for a period of eight hours, any items of equipment not suited to this pressure being disconnected during the test, and open ends capped.

All welds shall be hammer tested under pressure. Should any leakage occur the Contractor shall make good at his own expense notwithstanding that previous tests may have been satisfactory. If necessary the Contractor may have to test the system in sections and no extra will be allowed on this account.

After a satisfactory test under cold water pressure, and once the insulation is applied, the valves connected to the heating mains shall be opened up and the system shall be operated to ascertain that circulation is satisfactory with all controls functioning correctly and that the boiler burner assembly is operating at the manufacturers efficiency and that the system is ready for commissioning.

The Contractor shall be held responsible for efficient operation of the system and for defects arising out of faulty materials and workmanship.

4.0 HOT AND COLD WATER SERVICES

4.01 PIPEWORK AND FITTINGS

Pipe work shall be in light gauge copper to BS 2871, part 1, table x, with all joints made by capillary fittings or by bronze welding. Compression fittings may be used on pipe work exposed on the surface subject to approval by the Engineers.

4.02 SUPPORTS FOR PIPEWORK

Pipe work shall generally be supported by means of school board type brackets built in or screwed according to location. They shall be spaced and fixed firmly so as to minimise possible damage

4.03 RUN OF PIPEWORK

Where pipe work for hot and cold services is run in the washrooms and toilets particular care must be taken to ensure a neat and workmanlike installation. The Contractor shall include for going over his proposed pipe runs in detail with the Engineers before placing any pipe to ensure that position, clearances, bends, bracketing and location of fittings are acceptable.

4.04 STOPCOCKS AND VALVES

Stopcocks of the 'Ballofix' type or similar approved, shall be provided where required or indicated to allow isolation of supply, renewal of washers or other maintenance. Where possible they shall be so arranged as to control fittings or groups of fittings in individual locations, and shall be so mounted

such positions as to be screened by the fittings. No such stopcocks shall be fitted in exposed positions except with the Engineers approval.

Straight pattern, full way gate valves shall be provided on each flow, and where shown on the drawings for isolation. All to comply with B.S. 1010.

4.05 BRANCHES AND CONNECTIONS TO FITTINGS

Branch connections off mains to fittings shall be located in the positions shown on the drawings. All branches from the mains to the fittings shall be carried out on the surface, and made secure by bronze pipe saddles, multiple or single according to location and securely fixed to the wall. Connection to fittings shall be made by copper to iron adapters, Instantor fig. 312 or similar approved.

Contractors are to allow in their tenders for supplying and fitting gunmetal plugs to all connections to allow the entire concealed pipe installation to be tested before enclosure. Upon completion of satisfactory tests the plugs shall be removed and shall remain the property of the Contractor.

4.06 INSULATION OF COLD WATER STORAGE, EXPANSION AND CONDENSATE TANKS

Insulate with resin bonded glass fibre slabs with a nominal thickness of 32mm and a density of not less than 36kg/cubic m, similar to Newalls glass fibre bonded slabs or similar approved.

The slabs shall be finished with wire re-enforced aluminium foil, bonded to the tank with a suitable adhesive, mitred at the joints and sealed with 50mm wide self adhesive PVC tape. If the tank is fitted with a cover it shall be similarly insulated.

4.07 TESTING

After the installation is complete but before the insulation is applied, the pipe work and valves shall be pressure tested to 7 bar (100 psig) and shall remain drop tight at that pressure for a period of eight hours. All fittings shall be disconnected during the hydraulic test, and open ends capped. All brazes shall be lightly hammer tested while under pressure. Should any leakage occur the Contractor shall make good at his own expense, notwithstanding that any previous tests may have been satisfactory. If necessary the Contractor may be required to test the system in sections and no extra will be allowed on this account.

Outlets can then be opened one at a time to demonstrate that they can deliver the requisite flow of water.

5.0 MAINS WATER AND FIRST AID FIRE FIGHTING

5.01 PIPEWORK AND FITTINGS

Pipe work inside the building shall be in light gauge copper to BS 2871, part 1, table x, with all joints joined by capillary fittings or by brazing, and shall comply with the sections of the following clauses in the previous section where relevant:

- Pipe work and fittings
- Supports for pipe work
- Run of pipe work
- Stopcocks and valves
- Branches and connections to fittings

5.02 FIRE EXTINGUISHERS

The Contractor shall include for providing as necessary fire extinguishers in the locations as set out in the Equipment Schedule. Fitting of portable fire extinguishers shall be carried out under the main contract, whilst the fitting of fixed fire extinguishers in the boiler room shall be carried out under this sub-contract.

5.03 CONNECTION TO SITE MAIN

The contractor shall be responsible for the connection of the supply and installation of a secondary mains water meter within the boiler house. He shall also be responsible for the connection of the mains pipe work from within the boiler house to the external site main location directly outside the boiler house. The connection of the site main to the local authority supply is the responsibility of the main contractor.

The connection to the main shall be valve within the boiler house. The main shall enter the building as shown on the drawing through a suitably sized plastic pipe with easy sweep bend laid by the main Contractor. The main shall change from polyethylene to copper just above floor level and shall be valued before rising to high level.

5.04 INSULATION

Particular care shall be taken in the application of insulation at bends and fittings to secure a neat and workmanlike appearance to the insulation and to its finish.

The rising main to the water tanks and distribution pipe work to the drinking water appliances where run above ceilings, in wall cavities or ducts, or in plant locations or anywhere there is a risk of causing condensation shall be insulated.

6.0 SOILS AND WASTES

6.01 PIPEWORK

Soil and waste pipes shall be run in PVC pipe complying with BS 4514 with fittings generally in PVC complying with BS 5255. Other plastics such as polypropylene may be used for particular fittings and applications. Joints shall be solvent welded on PVC pipe, but special sockets with synthetic O-rings may be used in some cases, particularly with polypropylene. On no account shall solvents be used for jointing with polypropylene.

Pipe ends shall be cut square using a fine tooth saw and all swarf shall be removed with glass paper. The cut end of the pipe and the socket into which it will be inserted shall be cleaned with a patent cleaner recommended by the pipe manufacturer. In the case of PVC pipe an approved solvent welding cement shall then be applied to both clean surfaces in accordance with the manufacturer's instructions. The pipe shall then be fully inserted into the socket with a slightly twisting motion and any excess solvent removed with a clean cloth. The joint shall then be held firm in position for at least 20 seconds to allow it to set and should not be handled for at least 2 minutes.

In certain instances where soils and wastes are exposed on wall surfaces, wastes may be run in light gauge copper painted or chromium plated.

6.02 PIPE SUPPORTS

Plastic pipe used for soil and waste installations shall be supported generally as outlined in the Guide published by the Institute of Plumbing. Supports shall be spaced at not more than 12 times the diameter of PVC pipes 32mm and above whilst vertical pipes should be supported at intervals not greater than 24 times the pipe diameter. UPVC pipes shall be supported at intervals not greater than 8 times the diameter of the pipe.

Pipe supports shall be of a suitably designed galvanized metal collar or intermediate bracket and suspension for fixing to wall or underside of floor. Collars on vertical pipes should be located so that the support is at the boss branch. Metal pipe clips can be adapted to suit the outside of a vertical pipe by the addition of a barrel clip collar. UPVC pipe clips shall be used between anchor points and vertical pipes when it is necessary to accommodate some movement due to expansion.

6.03 TRAPS

Traps shall generally be in polypropylene unless otherwise stated, mounted immediately below the fitting and complying with BS 5572. All traps are to be accessible and provided with adequate facilities for cleaning, and where necessary be capable of being easily dismantled or renewed. Traps from bowl type appliances shall be in brass, chromium plated.

Minimum water seals shall be as follows: pipes up to and including 50mm size should have a minimum water seal of 75mm and pipes over 50mm should have a water seal of 50mm unless otherwise stated.

Bottle traps shall be used on wash-hand basins where the trap is exposed. Where syphonage may occur due to the arrangement of small discharge pipe work, resealing traps may be used only if the Engineers approval is obtained for each location.

6.04 SOIL AND WASTE CONNECTIONS

The Contractor shall allow for the connecting of all sanitary and other fittings with waste outlets to the soil or waste pipe work as necessary.

6.05 VENT COWLS

Vent cowls shall be provided on all vent outlets fitted with a guard or domical cage of durable material, or other material, which does not, restrict the flow of air unduly.

6.06 BLANK CAPS AND CLEANING DOORS

Blank caps and cleaning doors shall be provided at all locations where roding access is necessary for cleaning and the removal of blockages. Generally their location is shown on the drawings but the Contractor shall consult with the Engineers to see whether any additional cleaning doors are necessary.

6.07 CONNECTION TO MAIN CONTRACTORS DRAINAGE

The Contractor shall make-off all soil and waste connections to the sockets provided under the main building contract, which are generally to finish flush or close to the floor. Where this is of PVC a joint ring socket should be located at ground floor level to allow some differential movement without damaging the vertical stack.

Where connections are to cast iron a ring seal collar shall be fitted and caulked with lead and gaskin. Where the connection is to a clay drainpipe a 2:1 sand and cement adapter and gaskin shall be used around the ring seal.

6.08 INSPECTION AND TESTING

All sanitary pipe work installations shall be tested in accordance with BS 5572. Inspections and tests should be carried out according as the work proceeds to ensure that all work is free from defects, sound and unblocked before building work encloses it or making it more difficult for access.

Completed work shall be carefully inspected to see that no foreign matter is lodged or has adhered within the pipes or fittings, and that no jointing materials projects therein. It should then be tested for performance and soundness.

The soundness test shall be carried out by charging the water seals of all fittings and inserting test plugs and bags into the open end of all pipes to be tested. Allow a small quantity of water into the lowest plug or bag to ensure a good seal. A tee piece shall be provided at one opening, fitted with a cock at each end. A manometer should be connected at one end of the cocks so as to measure the air pressure inside. Alternatively the manometer can be connected through a suitably modified plug, or through a flexible tube inserted in through a water seal, any water in the flexible tube being removed. Air should then be pumped into the system until a pressure of 38mm swg is achieved. The pressure should be maintained for a period of five minutes.

Should a drop in pressure indicate a leak at a joint this should be located by applying a soap solution to the joints. Smoke should not be used on UPVC or MPVC pipes due to the risk of naphtha damage. When the system is complete it should be tested to ensure that all appliances drain speedily, quietly and completely, after which it should be tested for self and induced siphonage in branches, and for induced siphonage and backpressure in discharge stacks, as set out in BS 5572. Fittings should be filled to overflowing, the plug pulled, and the seal checked by dipstick or otherwise after emptying to ensure that at least 25mm seal remains. WC's should be similarly tested by flushing. Each test shall be repeated 3 times, and the maximum loss of seal taken as the most significant result. Where a range of appliances are connected to a common discharge, the number to be tested simultaneously should be as set out in Table 14 of BS 5572, the seal remaining in all traps being measured at the end of the discharge.

Tests for induced siphonage and backpressure in discharge stacks should be carried out by discharging the requisite number of fittings close to the top of the stack, simultaneously, as set out in Table 14 referred to above. Baths should not be used for discharge in either test.

7.0 COMMISSIONING, INSTRUCTION OF STAFF AND HANDOVER

7.01 EXTENT OF WORKS

This section covers the commissioning of all services of this specification

7.02 ORDER OF COMMISSIONING

The Contractor shall allow for the commissioning of the services in the following order:

- Domestic cold water

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- Mains water and first aid fire fighting
- Ventilation and air conditioning
- Boiler house plant
- Space heating
- Domestic Hot water

7.03 PRINCIPLES AND PROCEDURES OF COMMISSIONING

The Contractor shall carry out tests in accordance with C.I.B.S.E. commissioning codes and the following B.S.R.I.A. Application guides:

- Commissioning of Pipework systems: design considerations.
- Pre-commissioning cleaning of water systems.
- The commissioning of water systems in buildings.
- The commissioning of air systems in buildings.

7.04 CLEANING AND FLUSHING OUT

Before the Engineers authority to commence filling the system prior to commissioning is given, the Contractor shall satisfy the Engineer by means of a written report that the procedures as laid down in the Commissioning Codes as to system cleanliness have been complied with. The report shall set out in detail the procedures adopted in flushing out, cleaning by forced circulation, or chemical cleaning and inhibiting should this be decided. The report should set out, separately for each service, the personnel involved, locations dealt with and dates and times of operations, the flow rates and pressures involved, and other such matters as the Engineer may deem pertinent.

7.05 FILLING OF SYSTEMS

When the Engineer is satisfied as to the physical and mechanical checks that have been carried out, the Contractor shall fill the system with treated water to a prepared plan agreed by the Engineer, filling from the bottom upwards, where possible, so that air is moved to the appropriate points at a higher level in the system for venting.

7.06 INITIAL SETTING TO WORK

When the Contractor has indicated to the Engineer that all checks have been carried out, he shall arrange to operate the systems generally in the order set out in clause 7.02. Initial setting to work shall be carried out before heat is applied to the system so that design primary rates of circulation shall be established and any likelihood of primary flow rate variations due to modulation of unbalanced

secondary systems have been eliminated. Before start up of the boiler plant the Contractor shall report to the Engineer on the start up of each system and shall assure the Engineer of their satisfactory operation before start up of the boiler plant.

The start up of the boiler plant itself shall be carried out by the specialist supplier concerned and the Contractor shall ensure that they are kept informed of the check out processes so that their arrival on site is properly planned. No claims will be entertained for any nugatory expenditure by specialist commissioning staff due to the failure of any subsidiary system, which might delay commissioning specialist plant.

The commissioning staff shall ensure that all isolating and regulating valves are fully open and that all normally closed valves are closed, and that thermostatically controlled valves can be fully opened or closed if required by the commissioning staff. Pump return valves and fan inlet dampers should be closed for initial start up to limit any excess starting current due to bearing stiffness.

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Boheh, Liscarney, Westport Co. Mayo

7.07 REGULATION OF FLOW

Circulating flow systems shall be regulated by proportional balancing as specified in the codes. The Contractor shall obtain from the Engineer a list of design flow rates and acceptable tolerances before commencing balancing operations.

7.08 COMMISSIONING RECORDS AND REPORTS

All checks, measurements and adjustments must be recorded in writing at the time they are made by the commissioning staff, and copies made available immediately to the Engineer. The form that this report will take shall be agreed with the Engineer prior to commissioning.

When the Contractor is satisfied that the plant and systems have been correctly commissioned, he shall submit a final report to the Engineer, setting out all matters relevant, including all modifications and modifications to the systems and their controls, and listing all valve, damper and control settings, and normal operating flows, pressures, temperatures, running and starting currents and other operating characteristics. The final format of this report shall be agreed with the Engineer before completion.

7.09 HANDOVER OF SYSTEMS

When the Contractor has satisfied the Engineer that all commissioning has been completed satisfactorily, that the Clients staff have been adequately briefed on all plant and in all maintenance procedures, that all spares have been duly handed over and placed in stores, and that all instruction and maintenance manuals, together with all record drawings, have been delivered to the Client and the

Engineer, the Engineer shall issue Completion Certificates to the Contractor. Each section of the plant shall then be handed over to the Clients representative in the presence of the Engineer.