

# **GENERAL SPECIFICATION FOR MECHANICAL SERVICES STANDARDS OF MATERIALS AND WORKMANSHIP**

AT

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PREPARED FOR

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**REFURBISHMENT SCHEMES (2018)**  
**MECHANICAL SERVICES SPECIFICATION**

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## **PART I: GENERAL CONDITIONS TO ALL MECHANICAL SERVICES WORKS (2018)**

**Note:** This specification to be read in conjunction with the General Maintenance Upgrade Works Main Contract, Preliminaries and Standard Form of Contract to be implemented 2018. This standard specification Parts I, II and III relate to the standards of practice, workmanship and materials common to all sections of the contract. It is to be read in conjunction with the 'Particular Specification', which is specific to each project listed and issued as Part III of this specification.

### **A: Form of Contract**

You will be required to work on the JCT 2011 minor works standard form of contract as **Principal Contractor** for the Mechanical Services and associated specialist services works as outlined in this specification Parts I and II, and Part III Particular Specification relevant to the project.

The Principal Contractor may also be referred to in this specification as the 'General', or, 'Main' Contractor and is always deemed to be the Mechanical Services Contractor.

The Project Manager and Services Consulting Engineers hereinafter referred to in this document as PM/SCE shall mean 'Gerald W. Grey & Associates' who have produced these Services Specifications and documents. In addition, you, the Mechanical Services Contractor hereinafter referred to as 'Contractor', or, 'Mechanical Contractor', will allow in your tender for all of the following sections of this specification together with the relevant Particular Specification.

#### **1.1 Imported Labour**

The Mechanical Contractor shall be responsible for the provision of the requisite labour force to execute the works and for this purpose he should assume that he may have to import labour. The Mechanical Contractor shall therefore allow for all costs incurred by complying with the working Rules of the National Joint Council of the trade concerned, or, with the properly authorised Local Joint Council's Rules, whichever is applicable, and the employment of his own or any imported labour.

#### **1.2 Travelling Time and Subsistence**

The Mechanical Contractor shall include in his estimate for the cost of all travelling time, travelling expenses and subsistence allowed and all other similar costs that may be incurred by his work people and those of his Sub-Contractors.

### **1.3 Extra Works**

Where extra works are ordered on a daywork basis they will be paid for at the rate applicable to the area in force at the time, and the rates agreed on the tender Schedule of Analysis and/or the schedule of rates subsequently agreed with the successful tenderer.

Time and material sheets for such work fully detailing the extent of the operation must be delivered in duplicate to the Project Manager and Services Consulting Engineer (PM/SCE) for verification at or before the end of the work, following that in which at or before the end of the week, following that in which such work shall have been carried out. The PM/SCE are to be given access to receipts and invoices to enable them to check cost price charges. The Mechanical Contractor is to complete and return with his tender the schedule relating to daywork costs.

### **1.4 Inclement Weather**

The Mechanical Contractor shall take all reasonable measures, to protect and cover any work which may prove necessary to suspend where this is adversely affected by inclement weather, and, to minimise delays during these weather conditions. The Mechanical Contractor is to allow for the necessary precautions in his tender.

This may not be relevant in the case of conversion involving internal areas of an existing building.

### **1.5 Overtime or Anti-Social Hours Working**

The Mechanical Contractor shall allow for any overtime or anti-social hours working which may be necessary during the execution of this contract as no claim in respect of overtime, however worked, will be entertained except when specifically instructed.

### **1.6 Time and Progress Chart, Method Statement, Cash Flow Forecast and Site Meetings**

Within 2 weeks of acceptance of the tender, the Mechanical Contractor shall produce in conjunction with his Sub-Contractors, a programme for the works for use by the parties. The programme will be required as follows:-

- 1.6.1 A preliminary programme as a simple bar chart for discussion. \*
- 1.6.2 After agreement of 1.6.1 a revised programme detailed with critical paths is to be produced by the Contractor.
- 1.6.3 The Mechanical Contractor will be required at the same time to produce a method statement for his intended works. \*

1.6.4 As a financial aide the Mechanical Contractor is to also provide a projected cash flow forecast for the whole of his works based on the above. \*

\* **1.6.1, 1.6.3 and 1.6.4 are all required at the same time (as stated in Main Contract, or, two weeks after acceptance).**

1.6.5 The Mechanical Contractors representative should allow for attending periodical site meetings as required.

**N.B:** For the purpose of tendering allow for possible formal progress meetings at **fortnightly** intervals with weekly site inspections.

In addition, he shall be available for any discussions deemed necessary by the PM/SCE during their attendance to site progress meeting.

## **1.7 Labour and Material Sheets**

Daywork must only be executed after the receipt of written instructions from the PM/SCE and after the work has been executed the sheets are to be submitted for signature in an approved manner to him within the time stated. (This condition will be rigidly enforced).

## **1.8 Samples and Mock-ups**

Refer to Clause A33.1 and the Particular Specification(s) where these will be identified.

## **1.9 Prime Cost and Provisional Sums**

All PC and Provisional Sums included in the specification represent nett cost to the Mechanical Contractor. The amounts of all PC and Provisional Sums shall be deducted from the Contract Price, and there shall be added in lieu thereof the amounts in respect of these items actually expended by the Contractor, in accordance with the instructions of the PM/SCE. No variation shall be made in the sum included by the Contractor for fixing charges etc. In respect of PC or Provisional Sums but, such sums shall be omitted or varied in the case of mission or variation of the works, goods or services.

## **1.10 Inspection**

The Mechanical Contractor shall afford every facility to the PM/SCE and their authorised representatives for the inspection for the works installed in compliance with this specification.

### **1.11 Interpretation of the Specification and when appropriate Schedules of Work .**

If there should be anything in the following specification/schedules which, in the opinion of the Mechanical Contractor is ambiguous or otherwise not clear, he is to contact only the PM/SCE immediately before submitting his tender, in order to request clarification. If there is not time to do this before submitting his tender, he is to draw attention to the matter in a covering letter sent with the tender form, stating exactly what he has allowed for in his tender. This is not to be stated on the tender form itself. Where this has not been done the PM/SCEs interpretation of the specification/schedule will be adhered to.

**Important Note:** No alternative or substitute equipment or materials to those required by this specification will be allowed except and only where previously agreed with the PM/SCE prior to the Tender being submitted.

This condition will be strictly enforced and any unapproved materials delivered to site or used will be removed and replaced at the Mechanical Contractors expense, see also 1.16. Where there are options offered in the specification/schedule the Mechanical Contractor is to state with his tender what option has been allowed for in the tender.

### **1.12 Voltage and Temporary Supply**

The Mechanical Contractor shall allow for the provision of tools and equipment for safety working voltages and for associated transformers.

### **1.13 Valuations of Work in progress and Amendments**

Notwithstanding any contractual obligations or responsibilities as determined by the standard form of contract and conditions, the Mechanical Contractor will provide to the PM/SCE any financial information or assistance that may, from time to time, be required by the PM/SCE, to support or substantiate the Contractors interim applications in respect of works to date, or, financial claims, or, amendments to the contract works. Failure by the Contractor to provide such information in sufficient time or detail will result in the PM/SCE assessments of payments due being implemented for the purpose of valuations.

### **1.14 Builders Work in Connection with Services (BWIC)**

All BWIC with services will be carried out by the Principal Mechanical Contractor to final details issued by the respective trades which shall include any major holes previously determined by the M&E Consultants.

### **1.15 References**

Client refers to the Sports Centre and/or Corby Borough Council. Where this specification refers to the following parties they shall mean the firm or representatives of the M&E Consultants comprising:-

Client and Contract Administrator	Corby Borough Council
Project Manager & Services Consulting Engineers (PM/SCE)	G W Grey & Associates (GGA)

### **1.16 Specified Specialist Contractors, Suppliers or Materials**

Where specifically referred to in this specification by name all Specialist Contractors, Suppliers or Materials must be accepted in their entirety. No alternatives will be accepted without the PM/SCE's prior agreement. Further, if during tender stage an alternative is to be proposed by the Tenderer then prior approval must also have first been obtained from the Consultant. When this is not followed these materials, or, services, or, installation will be replaced at the Contractors cost.

### **1.17 Acceptance of Tender**

The Client and the M&E Consultants are not obliged to accept the lowest or any tender submitted for this project. All tenders to remain open for the minimum period stated in the tender invitation.

### **1.18 Health and Safety Precautions/CDM Regulations**

The Mechanical Contractor is to provide a health and safety plan for his work together with those of his Sub-Contractors work with full details, documentation, risk assessments, and method statements which will be required in compliance of CDM regulations for the CDM Co-ordinator/PM/SCE. In addition, the Contractor is to provide to the CDM Co-ordinator any further details they may request for specific tasks which arise during the course of the works. The Contractor is to allow all costs associated with the full CDM provisions of this requirement.

### **1.19 British Standards**

All materials, not specifically referred to by name shall be selected from approved British manufacturers and complying with the relevant British Standards. Where such materials do not exist, then they may be selected from European manufactures and manufactured to the appropriate EURO standard.

## **1.20 Standardisation**

A policy of standardisation of equipment and materials is to be adopted wherever possible and in general compliance with the requirements of this specification.

## **1.21 Asbestos or Deleterious Materials**

Under no circumstances will any new material be used which contains asbestos or deleterious materials. Where new installation involve the disturbance in any way shape or form of any material whether positively identified or suspected of containing asbestos or other harmful materials, the Contractor will be responsible for having samples taken for the purpose of identification or analysis, and, for advising the CDM Co-ordinator and PM/SCE of the results so that the appropriate action can be taken. All testing to be undertaken by an independent testing laboratory or Authority and the cost of this is to be included in the works. Current Asbestos registers are available for each site for the Contractor to refer too.

## **1.22 Access, Platforms, Lifting and Hoisting**

The Principal Services Contractor will be required to allow for providing all general access, platforms, lifting and hoisting equipment necessary for the project in general accordance with the JCT contract forms at the end of this specification. The Mechanical Contractor will be responsible for providing the necessary method statements for working on these to comply with CDM regulations, and, for agreeing a programme of usage with all those involved. See also clause A43.1 regarding supplementary access equipment.

## **1.23 Special Works (BWIC)**

Where Mechanical Services are to be installed in floor, ceiling or roof spaces involving cutting notches or holes in the structure and in particular timber to accommodate lateral concealment, then the following B.S.R.I.A. document is to be adhered to:- Construction Quality Forum ref: CQF/M&E detail Sheet ME2 published April 1997 'Accommodating M&E Services within Building Tolerance'.

**The Principal Mechanical Services Contractor will be responsible for all builders work associated with the Services covered by this specification and is advised to employ a specialist Builder for these duties and must include all costs in their tender.**

## **1.24 Volatile Organic Compounds**

**Wherever practical Volatile Organic Compounds (VOC's) must be avoided.** Manufacturers are beginning to add details on their products but decoration

materials, flooring sealants and adhesives are likely to be the main products where particular care is to be taken.

**Of particular concern with known harmful affect on Children and young adults health are the following VOC's:-**

Acetaldehyde	Acrolien	Benzene	Formaldehyde	Phenol
Pentachlorophenol	Toluene	Xylene	4-Phenylhexane Styrene	Decane
Butoxyelthanol	Isopentane	Limonene	Percholoethylene	
Methylene Chloride	Vinyl Chloride			

The Mechanical Contractor and his Sub-Contractors will each be required to demonstrate at the commencement of the contract that they have taken all possible steps to comply with this new requirement.

### **1.25 Building Regulations Part L2(h): Log Book**

In addition to O&M Manual and Record Drawings, the Mechanical Contractor is required to produce separate log book section to comply with 'The Requirements' of Building Regulations Part L2(h) on page 8: "providing sufficient information with the relevant services so that the building can be operated and maintained in such a manner as to use no more energy than is reasonable in the circumstances". Include concise sub-sections/titles for; PC/handover, reviews/responsibilities of the manager, links to other/main document etc, commissioning compliance, outline design with key do's and don'ts, summary of areas/occupancy and activities, overview of controls/settings, occupant information/efficient cost saving measures, monitoring controls/setpoints and any sub-meters included, performance record/table for end use comparison, maintenance review etc. and log sheet for results of in use investigations/record of defects liability work and evaluations.

One **Draft** copy of log book section must be issued to the PM/SCE for comment prior to formal issue of final document at PC/handover compete with electronic copy of the same on CD, and for the PM/SCE records.

### **1.26 Preferential Discounts**

The Mechanical Contractors attention is drawn to any special preferential discount arrangements which may have been made with manufactures/suppliers. This arrangement gives special discounts to the **Client** and the Contractor must allow for crediting this cost saving in his tender for the particular material specified as supplied by the appropriate firms. Wherever a specialist manufacturer and/or supplier is specified, the Contractor must place their order with them unless otherwise agreed with the PM/SCE. Failure to do this will render the Contractor liable for replacements, or, financial reimbursement of the cost benefits which the Client could reasonably have expected to have derived had the PM/SCE instructions referred to herein been properly complied with.

**PART II: STANDARDS OF PRACTICE, MATERIALS AND WORKMANSHIP**  
**MECHANICAL SERVICES**

**SECTION ONE:**  
**GENERAL REQUIREMENTS**

**SCOPE**

**NOTE:** The following standard specification M&E No 3 has been appropriately modified and updated together with the Particular Specifications that will apply to this contract as modified/described as follows:-

**1.01** This specification relates to the on-site investigations, manufacture, works testing, supply and delivery to site, erection, connecting up, site testing, adjusting and setting to work of low temperature hot water heating and domestic water services installations, and associated LPHW boiler and DHWS generation and plant supplies and all relevant HVAC services within buildings as described herein.

**NOTE:** In this instance the following specification and the Particular Specification Specifically refers to the **LPHW HEATING BOILER HOUSE PLANT AND ASSOCIATED SERVICES ONLY WHEN REQUIRED WILL BE COVERED BY THE RELEVANT PARTICULAR SPECIFICATION – Part III**

Where existing services are to be fully or partially retained and therefore covered by this specification, consequently the Contractor shall allow for the refilling and venting of the these services within the building including any rebalancing and setting to work that may be necessary.

**RELATED DOCUMENTS**

**1.02** This specification shall be read in conjunction with the conditions of contract, the 'Particular Clauses' as given in the relevant Particular Specification, schedule(s), and drawing(s) issued with it and enumerated in the invitation to tender or in the Appendix to the 'Particular Clauses'. In the event of a discrepancy between this specification and its related documents and any drawing, the drawing shall be followed and the SO informed. **NOTE:-** Where record drawings are offered it is the Contractors responsibility to verify the accuracy of the information shown as many amendments to the systems may have taken place over the years.

**REGULATIONS PUBLISHED BY THE AUTHORITY**

**1.03** All work shall be carried out in accordance with the Authorities relevant Safety Regulations which may be seen on request to the SO.

## OTHER REGULATIONS

**1.04** The installation(s) shall comply with all relevant statutory instruments and regulations with amendments current at the date of tender (unless stated otherwise in this specification or on any drawing) and in particular with the following:-

- (1) The IEE Regulations for the Electrical Equipment of Buildings (17<sup>th</sup> Edition) BS7671: 2008 amendment 3:2015 and subsequent 18<sup>th</sup> Edition amendments expected to be published 2<sup>nd</sup> July 2018 for full implementation 1<sup>st</sup> January 2019.
- (2) Regulations under the Factories Acts.
- (3) Regulations under the Electricity Acts.
- (4) Gas Safety Regulations 1998 and relevant Codes of Practice including all amendments and those expected April 2018 and CLEAPSS L14 2000 as it relates to Gas.
- (5) Any special requirements of the local Electricity or Water undertakings including the latest model water supply byelaws and regulations.
- (6) Not Applicable.
- (7) All the latest Building Regulations including all amendments from April 2018 and in particular the requirements of Part G and L conservation of fuel and power in buildings other than dwellings.
- (8) The latest Health and Safety Regulations issued by the Health and Safety Executive.
- (9) The CDM Construction (Design and Management) regulations CDM 2015 issued by the Health and Safety Commission and subsequent amendments.
- (10) The Water Supply Regulations 1999. SI1148 incorporating SI1506 and amendments including Issue 3 December 2016.
- (11) The safe disposal and waste management WEEE regulations 2017.

## COMPLIANCE WITH BRITISH STANDARDS

**1.05** The equipment and/or installation(s) shall comply with all relevant British and Euro Standards and Codes of Practice. In the event of a discrepancy between this specification and any BS or CP this specification shall be followed.

## ELECTRICITY SUPPLY

**1.06** Unless otherwise indicated all apparatus and wiring shall be suitable for use with the normal **single phase or 3 phase** earthed neutral system available in the UK. Refer also to the Particular Specification.

## DEFINITIONS

**1.07** For the purpose of this specification the following definitions apply:

- (1) Low temperature hot-water (LTHW) system. A system which operates at temperatures up to a maximum of 95°C but is not part of an MTHW or HTHW injection system.
- (2)to(4) Inclusive are not relevant.
- (5) Gas supply- natural gas supplied by Gas Supply Company.
- (6) Approved – Approved by the SO (Services Consultant); normally a design or piece of equipment which must be shown to have operated successfully for not less than two years under conditions generally similar to those required by this contract:
  - (a) Facilities shall be given at the tender stage, if required by the SO, to enable him to evaluate the equipment's features and performance.
  - (b) The approval of a design piece of equipment shall be without prejudice to the acceptance tests required after installation.

**NOTE: No alternative manufacturer or equipment or plant to that specified will be considered unless approval has first been given by the PM/SCE during the tender period.** This requirement will be strictly enforced and the Contractor will be required to replace any unapproved materials or equipment at his own cost (see previous items 1.11 and 1.16).

- (7) Size – When related to pipework means nominal size which generally approximates to the bore of steel tubes and the outside diameter of copper tubes.
- (8) Domestic Water Services – A system or systems of mains cold water, tank or boosted cold water and hot water secondary flow and when applicable return.
- (9) Authorities – When referred to in this specification shall infer 'The Client – The Sports Centre, and, SO shall infer the PM/SCEs Messrs G W Grey & Associates (GGA).

## EXTENT OF WORK

**1.08** The work shall comprise the whole of the labour, and, unless otherwise indicated, all the materials necessary to form a complete installation and such tests, adjustments and commissioning as are prescribed in subsequent clauses and as may otherwise be required to give an effective working installation to the satisfaction of the SO.

**NOTE:** In this context of the work relates to the **REPLACEMENT OF LTHW SPACE HEATING BOILERS, PRIMARY FLUES, HEATING PUMPS AND ASSOCIATED MAINS PIPEWORK ONLY, THERMAL INSULATION, TESTING AND VERIFYING EXISTING HEATING DISTRIBUTION SYSTEM BUT INDEPENDENT DOMESTIC HOT WATER GENERATION AND DOMESTIC WATER SYSTEMS, AIR HANDLING AND MECHANICAL VENTILATION TO BE RETAINED**, except where indicated and specified as part of these boiler replacement schemes complete with all associated feed and expansion plant/equipment and associated control systems upgrade.

- 1.09** The words ‘complete installation’ in clause 1.08 shall mean not only the major items of plant and equipment conveyed by the specification, but all the incidental sundry components necessary for the complete execution of the works and for the proper operation of the installation, with their labour charges, whether or not these sundry components are mentioned in detail in the tender documents issued in connection with the contract. Also refer to particular specification and appendices.
- 1.10** Where cold-water services inside buildings do not form part of the work the DHW services shall terminate within 450mm of each sanitary fitting or range of fittings.  
**NOTE : This contract is to include for all final connections to appliances.**
- 1.11** The words ‘as indicated’, ‘where indicated’, ‘unless otherwise indicated’, refer to items or requirements which are or may be given elsewhere in the tender documents issued in connection with the contract, eg: on a drawing, or in the Supplementary Specification issued separately.

#### **METRICATED PRODUCTS**

- 1.12** Where any products and equipment required by this specification are no longer available at the tender stage in the measurements or units stated and must or may otherwise be provided as alternative metricated or fully metricated products and equipment complying with more recent British Standards, the changes shall be declared by the Tenderer with his tender return.
- 1.13** Where the variations referred to in clause 1.12 occur during the course of the contract, the alternatives shall be brought immediately to the notice of the SO for his decision on how the contract shall be varied.
- 1.14** Variation of the contract as referred to in clause 1.13 shall imply the acceptance at no extra cost, of alternative metricated products of no less quality and performance than those accepted at the date of the contract, including any incidental sundry components and works arising from their substitution. Such variations shall not prejudice the Contractor’s normal right to submit a claim for costs (any savings would be credited to the Authority) arising from metrication which unavoidably result in the partial or total redesign of the planned installation(s), or alterations to the works already executed.

## **DRAWINGS**

### **1.15 General**

Unless otherwise indicated, the Contractor shall allow in their tender all costs to provide the following drawings to the satisfaction of the SO.

- (1) **TWO** sets of Installation drawings including Builder's work drawings.
- (2) **TWO** sets of detailed plant room drawings.
- (3) **TWO** sets of drawings of any variations approved by the SO.
- (4) **TWO** complete sets of purpose-made diagrams detailing separately all the composite electrical circuit and wiring layouts and/or, where application, the pneumatic circuitry, within the installation.
- (5) **TWO** complete hard copy sets PLUS 2 CD's of Manufacturers' 'as made' drawings where required by this specification.
- (6) **TWO** complete hard copy sets PLUS 2 CD's (see also subsequent clauses) of 'As installed' drawings upon completion of the works and at handover.

- 1.15** The first set of drawings as detailed in clause 1.15 (1), (2) and (4) shall be sent to the SO within two weeks of the acceptance of the tender or such other time as agreed with the SO.

### **1.17 Builders Work Drawings**

Where these are required the Builders work drawings shall show fully dimensioned all bases, holes, bolt sinkings etc. necessary for the boiler and associated equipment.

NOTE: Conventional pump bases are not required.

Refer also to the Particular Specification issued separately.

### **1.18 Electrical Control Diagrams**

- (1) Composite circuit and layout diagrams for Electrical Services associated with Mechanical Services shall detail not only all circuitry within main control panels but also connection diagrams for all external equipment such as starters, thermostatic control devices, together with all interconnecting wiring from the main point of supply onwards and all terminal markings.
- (2) The sizes and types of all cables and pipes shall be indicated on the layout diagrams together with the ratings of all such items as fuses and switches.
- (3) Circuit diagrams shall, where possible, be so arranged that the sequence of events is from left to right and from top to bottom of the diagram. Diagrams shall generally comply with BS 3939.

- (4) If abbreviations are employed for the designation of components an integral schedule shall be provided on the drawings to explain the meanings of the abbreviations.
- (5) A print of each of the composite circuit and layout diagrams shall be fixed securely to the inside of the hinged front of the main electrical control panels, as appropriate, or, in such other positions as may be agreed with the SO and shall be protected by non-flammable transparent material. Where inadequate space exists the prints shall be suitably reduced in size.
- (6) Individual circuit and layout drawings from components manufacturers will not be accepted in lieu of composite diagrams.

#### **1.19** 'As Installed' Drawings

- (1) The Mechanical Contractor shall provide **Two** hard copy sets PLUS 2 CD's of the 'as installed' drawings on completion of the work and as a condition precedent to the certification by the SO that the work is complete.
- (2) Each drawing shall be in accordance with the BS308, Part 1 (to ensure suitability for microfilming), and, shall be 2 No copied to paper, of a standard size A0 to A4 of BS3429, and, should include 2 No electronic copies on CD.
- (3) During the course of the works the Contractor shall maintain a fully detailed record of all changes from the post tender working drawings/details to facilitate easy and accurate preparation of the 'as installed' drawings and to ensure that these drawings are in all respects a true record representative of the new installation provided under this contract.
- (4) The drawings shall show:
  - (a) The complete installation including the sizes and runs of all pipework;
  - (b) The precise location of all pipework which is buried within the structure and those sections of any external distributing pipework which are laid solid in the ground.
  - (c) The precise positions of all main supplies and underground incoming service points at the entry to building(s) or boiler house, giving their depth and the locations of the service MAIN isolating valves or cocks and meter equipment;
  - (d) Any special thermal or other protecting envelopes around services which are buried.
  - (e) The geographical location and identification number of each circuit control valve in accordance with the labelling and circuit control diagram required by clause 7.10;
  - (f) The names of the manufacturers, model and type numbers and all details of duty and rating of all items of plant including thermostatic control equipment;
  - (g) The contract number, the name of the Contractor and the date of the installation.

**In addition:** Upon completion and at handover the Contractor will supply **TWO** full size prints of each of the approved 'as installed' drawings together with 2 copies on disk of any CAD prepared drawings.

## **PAINTING**

**1.20** Ferrous sheet metal work not galvanised shall have a protective coat of paint or other approved material before despatch from works. Other ferrous materials shall receive a protective coat at works where it is the normal custom. Any deterioration or damage to manufacturer's protective coating during storage and following installation shall be made good to the satisfaction of the SO.

**1.21** A Specialist Painting Contractor shall be responsible for painting:

(1) Exposed pipework, walls and floors of plant rooms (Applicable only when specified – refer to Particular Specification).

**1.22** The Mechanical Contractor shall ensure that surfaces of all ferrous metal work including pipework, hangers, supports, etc, which are not to be insulated shall be primed and finished with two coats of good quality non-metallic paint of approved colour. The surfaces of all ferrous pipework which is to be insulated shall be primed and finished with one coat of good quality paint. Where the surfaces will be subjected to temperatures above 100degC, the finished coat(s) shall be heat resisting paint and the primer omitted. The Contractor shall also ensure:

- (1) That surfaces are cleaned before they are painted;
- (2) That those parts of the installation required to be left unpainted (eg: brasswork) shall be so left;
- (3) That the pipework services are correctly identified in order to facilitate the use of approved paint of the correct colour to comply with BS1710 and the SO's instructions.

**1.23** Not Applicable.

**1.24** Builder's Work in connection with Services

The Principal Mechanical Contractor will be responsible for all Builders work associated with this contract to details supplied by the Manufacturers and specialist services contractors' – See also Particular Specification relevant to the appropriate building.

## **SECTION TWO - CENTRAL PLANT**

### **BOILERS**

**2.01** Boilers and their firing equipment shall be fully automatic, of approved design and shall conform to the special and specific requirements of any supplementary and/or the Particular Specification.

**2.02** The minimum operating combustion efficiencies at half to full load, based upon the gross calorific value of the fuel and determined as indicated in clause 12.19 to 12.27, shall be, for the various types of automatically fired boilers, and not less than the manufacturers published data.

**2.03** The efficiency as determined shall be not less than that declared by the Manufacturer.

**2.04** The Mechanical Services Contractor shall be responsible for ensuring that the boiler manufacturer has approved the firing equipment offered to match the boilers they are intended to fire, in order to ensure completely satisfactory service. Evidence of proved compatibility shall be given when requested by the SO.

NOTE : The firing equipment shall be that provided as standard with the boiler except when specifically required and listed in the Particular Specification.

**2.05** For LTHW heating and for DHWS, boilers shall be of cast-iron or stainless steel, purpose designed for firing by one of the following methods:

- (1) Gas with atmospheric burner;
- (2) Gas with forced automatic burner.

**2.06** Not Applicable.

**2.07** Water boilers shall be designed so that:

- (1) A positive water mixing is induced within the boiler;
- (2) Flue gas exit temperatures of gas-fired boilers shall be not less than 180° C.

**2.08** Equipment of boilers for water systems shall include the following for each boiler. The positions include the following for each boiler. The positions of these shall be in accordance with the manufacturer's standard arrangement:

- (1) safety valve or valves;
- (2) open vent pipe on low temperature and medium temperature systems when these are open to atmosphere;
- (3) altitude or pressure gauge;
- (4) thermometer
- (5) emptying cock(s) or drain valve(s);
- (6) a nameplate giving:
  - (a) maker's name;
  - (b) series and type;

- (c) serial number;
  - (d) rated output;
  - (e) design pressure;
  - (f) date of manufacture;
- (7) a plate bearing a distinct and easily visible number where two or more boilers are provided.

**2.09** Not Applicable.

**2.10** All necessary fittings and equipment for automatic control shall be provided with the boiler.

**2.11** Each type of boiler installation shall be supplied with one set of operating tools and a set of flue and tube cleaning tools appropriate to the boilers. The tools shall be hung on rack supplied and fixed by the Contractor in a position indicated by the SO.

**2.12** Brick/concrete boiler bases are already provided. Sectional boilers not designed to rest on purpose-made standards shall be assembled with continuous flat metal plates inserted between the undersides of the sections and the boiler base so that irregularities in the base do not obstruct or inhibit the correct mating of the sections one with another.

**2.13** Gas-fired boilers with atmospheric burners shall be provided with stainless steel flue pipe connections; each boiler flue outlet shall incorporate a down-draught diverter. Gas-fired boilers having forced air burners and boilers arranged for dual fuel firing (clauses 2.05(4) and 2.06(4)), shall have flue pipe connections in stainless steel. All boiler flue pipes shall be adequately supported and provided with cleaning doors and, where appropriate, plugged tappings for flue gas sampling (clause 2.43).

Where a boiler flue pipe connection is required to be connected either to a self-supporting steel chimney or to a proprietary type of flexible chimney lining, the manner of connecting up together with details of the chimney or lining shall be as indicated and/or agreed.

**2.14** Where two or more boilers, gas-fired with forced air burners, are connected to a common flue system and any of the boilers are rated in excess of 300 kW, each boiler shall be provided with a gas-tight shut-off damper. For the purpose of this specification, gas-tight means that any inefficiency in the dampers seating when closed shall not permit the leakage rate to exceed the volume passed by a circular orifice equal to 0.05% of the flue duct cross-sectional area. The SO reserves the right to have the gas-tightness demonstrated by tests before acceptance. The damper shall be either integral with the boiler or fitted in the flue connection from the boiler.

Each damper shall be electrically inter-locked with the firing controls to open and close automatically when the burner is cycling and in conjunction with the burner purge sequence. When the damper is in the closed position the burner controls shall be inoperative. The damper shall be free to fail safe by acting as an explosion relief to the chimney. Where, additionally, modulation of the damper to give draught control is required, this will be indicated.

- 2.15** An explosion-relief and flue-access door shall be provided for each forced air gas-fired boiler. All components shall be of corrosion-resisting alloys. Where the relief door is to be inserted into a brick or concrete flue it will be installed by the Builder to the Contractor's instructions.
- 2.16** Where copper systems are specified, DHWS boilers shall be power-barffed, or be given other approved protection, after all threads and tappings have been machined. Exceptionally, tappings made after protective treatment shall be provided with gunmetal plugs or bushes with threads to cover the full depth of the tappings.
- 2.17** On installations of two or more LTHW boilers, open to atmosphere, the open vent pipe from each boiler may be connected into a common vent pipe through a three-way cock (clause 7.05(12)), so arranged that in no circumstances can any boiler be isolated simultaneously from the open vent pipe and from the free outlet.
- 2.18** Heating boilers shall embody facilities for cleaning flueways. DHWS boilers used in direct systems shall embody facilities for cleaning flueways and waterways. Access doors shall be designed for simple removal and replacement and to close with a gas-tight seal. Hinged doors shall be provided with stops where necessary to prevent damage to insulation or cladding when the doors are opened.
- 2.19** Where possible all controls shall be arranged so that they are accessible from the boiler front.
- 2.20** Before insulation is applied all joints in the combustion chamber and flue pass system shall be sealed with heat-resisting medium against inward and outward leakage to suit the combustion chamber design pressure conditions.

## **SOLID FUEL INSTALLATIONS**

Not Applicable.

## **OIL FUEL INSTALLATIONS**

Not Applicable.

### **2.32 Foam Inlets**

Not Applicable.

## **GAS-FIRED INSTALLATIONS**

**2.33** Gas-fired boilers shall be capable of the duty indicated when burning gas of the calorific value or gas group number of the local gas supply. Gas burners shall be atmospheric or forced-air type complete with flame failure device, adjustable water-way thermostat or steam pressure switch, over-riding limit device, gas pressure governor, and permanent pilot or electric ignition. Boilers with a capacity above 135 kW shall be fitted with the flame electrode type of automatic pilot. Provision shall be made for a delay or purge period after gas shut-off following flame failure. The length of purge period necessary to ventilate the boiler shall be stated in the tender. The boilers shall be selected from the British Gas tested and Approved List. Installations using forced-air gas burners shall comply with Standards for Automatic Gas Burners, published by the British Gas and associated manufacturing authorities.

**2.34** Gas burner control shall generally comply with the requirements for oil burner control (clauses 2.25 (1) to (7) as appropriate).

**2.35** The Contractor shall run the gas supply to the boiler(s) from the points of connection as indicated.

**2.36** When the contract includes a gas supply into a building an external gas cock shall be located in an accessible position to be agreed with the SO. When secondary gas meters are not incorporated in the boiler house a further gas cock shall be positioned immediately after the gas main enters the boiler house.

NOTE : When an existing gas supply is to be reused it shall be upgraded as appropriate to current gas regulations.

## **DUAL FUEL-FIRE INSTALLATIONS**

Not Applicable.

## **HOT-WATER PRESSURISING EQUIPMENT**

### **(AS IT APPLIES TO AUTOMATIC PRESSURISATION EQUIPMENT)**

#### **2.42 Sealed Expansion Tanks with Internal Flexible Membrane**

- (1) Sealed expansion tanks shall only be used for pressurising LTHW heating installations.
- (2) The internal flexible membrane shall be replaceable.

- (3) The equipment shall include:
- (a) A permanently connected apparatus for initial water filling and water make-up including a break-tank and an electric pump. The tank shall be fitted with a ball valve and connection for cold-water supply, or it shall be fitted with water level controls and a connection for direct feed from the fixed water demineralising plant (clause 9.18 (3)) when installed.
  - (b) A high-pressure switch and a low-pressure switch both wired in series with the burner or stoker control gear to shut down the burner or stoker and to give a continuous audible warning when a dangerous condition arises (see also clause 2.44 (4)).

## **INSTRUMENTATION**

**2.43** In boiler houses of not less than 60 kW boiler rating a 20 mm size socket with a brass plug shall be provided in each furnace front for measurement of draught over the fire and a plugged 40 mm size flue gas sampling point shall be provided at each boiler exit and in the main chimney if common to two or more boilers. The connection shall comprise a short length of 40 mm size tube capped off with a screwed 40mm to 20mm size reducing socket and a ¼ inch BSP brass plug in the outlet. An additional 20mm size socket with a brass plug shall be provided near to each of the 40 mm size sockets.

**2.44** Not Applicable.

**2.45** In a hot-water heating boiler house where the total boiler rating is below 1200 kW dial-type thermometers shall be fixed in each boiler flow and in the common return. A dial-type thermometer shall be fixed similarly in the common flow main after the thermostatic mixing valve when one is fitted. The dial-type thermometers shall be as specified in Section Nine.

## **SECTION THREE – PUMPING EQUIPMENT**

Refer also to relevant Particular Specification for all new pump details.

### **Pumping Equipment**

#### **CIRCULATING PUMPS**

##### **3.01 LTHW Heating Systems**

- (1) Horizontal and vertical circulators may be of the following types:
- (c) For LTHW systems open to atmosphere only, special purpose pumps of the 'canned rotor' or similar glandless type may be used;

(d) Not applicable.

**NOTE:** Notwithstanding subsequent clauses the installation of all pumps shall strictly follow the installation recommendations of the manufacturers for each type and/or size of pump.

- (2) Each circulating pump shall be installed with a valve on the inlet and a valve on the outlet connections.
- (3) Motors and starters shall be in accordance with Section Eleven.
- (4) Dripless mechanical shaft seals shall be limited to system temperatures below 120°C. Where packed glands are provided, separate drip pipes shall be run to discharge visibly over the water sump in the boiler house floor. Alternatively, the Contractor shall provide a galvanised container to receive the discharge. The container shall be of at least 4.5 litre capacity and of nominal thickness not less than 1.6 mm.
- (5) Bearings shall be either sleeve type with oiling ring and reservoir, or ball or roller type with grease lubricator. The bearings shall be outside the stuffing box and shaft seal.
- (6) Each floor-mounted circulating set shall be properly levelled, bolted down and grouted-in, on a brick or concrete base of 300 mm minimum height which will be provided by the Builder. The Contractor shall be responsible for providing all dimensions and details to enable the bases to be set out. Anti-vibration mountings and flexible connections shall be provided. The Contractor shall ensure that the complete unit is efficiently balanced to eliminate noise and vibration. Belts, where fitted, shall be correctly aligned and tensioned.
- (7) Altitude gauges shall be connected to the main on each side of the circulator. Where duplicate pumps are provided the gauges shall be connected to the common suction and delivery mains. Wherever possible the gauges shall be wall mounted at the same horizontal level and provided with flanged backs. In other respects they shall be in accordance with clauses 9.04 and 9.05.

**Additional Clauses :**

- (1) Pumps will be as given in the relevant Particular Specification. All pumps to have 3 phase 415 volts motors except where listed otherwise.
- (2) All pump inlet connections to be fitted with Crane or equal Y type strainers WRAS certified PN32 screwed bronze fig D 297 up to 2" (50mm). Strainers will be equal size to the pipework to which they connect. Each strainer will be positioned on

pipework between valve and drain cock sets to enable easy isolation for maintenance and cleaning purposes.

- (3) Where pumps are provided for multi-service circuit or duty/standby each will be provided with a suitable non-return valve on the pump delivery side to prevent reversal of flow.

**3.02 MTHW Heating Systems**

Not Applicable.

**BOILER FEED PUMPS**

**3.03 General**

Not Applicable.

**CONDENSATE PUMPS AND RECEIVER SETS**

**3.04 General**

Not Applicable.

**SEMI-ROTARY HAND PUMPS**

**3.05** Not Applicable.

**OIL CIRCULATING PUMPS**

**3.06 General**

Not Applicable.

**SECTION FOUR**

**DISTRIBUTION INSTALLATION**

**TUBES AND PIPES**

As they apply see also Particular Specification and:-

- 4.01** Tubes and pipes shall be of the following types and as stated in the Particular Specification:-

The Contractor may at their discretion elect to use any of the following which is to be stated in their tender :-

(1) LTHW Systems

(a) For all new heating pipework use BS1387 (medium) mild steel.

(b) Not Applicable.

(c) Alternatively, the Contractor may elect to use copper to BS EN 1057 – R250 formerly BS2871 Part 1 Table X for half hard light gauge by Yorkshire Copper Tube, brand

name 'Yorkex' or approved equal with Xpress 'copper' Press-fit fittings or carbon steel pipe to DIN standard 2394/NEN 1982 and Xpress carbon fittings to EN100-27-IS205G2T.

- (d) When External below ground required Microflex PE/Xa pre-insulated duo pipework system by Watts Industries (The Wolseley Group) is to be used.
- (e) Where flexible non –metallic pipework is required to replace mild steel pipes in partially inaccessible floor ducts this will be with PP-R80 polypropylene of approved manufacture.

(4) DHWS Services

- (a) Not Applicable.
- (b) For all other new, replacement or extension use only: Copper to BS En 1057 – R250 formerly BS 2871 Part 1 Table X for hard hard light gauge by IMI Yorkshire Fittings Ltd, brand name 'Yorkex' or approved equal.
- (c) Not Applicable.

(5) Cold Water Services

- (a) Not Applicable.
- (b) Copper tubes as specified in Clause 4.01(4).

(c) **Water potable:**

- (i) Below ground external (single mains only) to be manufactured by Radius Systems Ltd, Hilcote Plant, P.O. Box 1, Blackwell, Nr Alfreton, Derbyshire, DE55 5JD. Tel: 01773 811112, www.radius-systems.com type PE80 (MDPE) light blue sizes 20 to 63mm and PE100 (HPPE) dark blue sizes 90mm to 1000mm both to BS EN 12201 Part 2.
- (ii) Not Applicable.
- (d) Where not applicable incorporated within Microflex PE/Xa a pre-insulated system as (1) (d) above.

(6) Gas Supplies

- (a) Tubes and pipes used outside buildings and underground – Not applicable.
- (b) Pipe 'risers' inside multi-storey buildings (buildings of more than five storeys or above 20m high) shall be mild steel BS1387 'Heavy'.
- (c) Other gas pipes inside buildings shall be mild steel BS1387 or WICU<sup>®</sup> GAS light gauge yellow plastic coated copper coils BS EN13348 copper tube to BSEN 1057 by Yorkshire Copper Tubes as indicated. Steel tubes shall be 'Medium' except for those screwed in the 20mm and 40mm sizes which shall be 'Heavy'.

- (7) Oil Fuel Lines  
Not Applicable.
- (8) Special Rainwater Harvesting  
Not Applicable.
- (9) Drainage  
Not Applicable.

## **PIPEWORK JOINTS AND FITTINGS**

### **4.02 LTHW Systems Open to the Atmosphere and Sealed LTHW Systems**

- (1) Joints on all permanently concealed pipework and all pipework over 100mm size shall be welded. All other pipework may have screwed or welded joints. Where the Contractor elects to use screwed joints at least one of the two engaging components shall be taper threaded and the jointing between them shall be made with approved jointing material.
- (2) At dismantling points or where the pipework is connected to an appliance, ground-in spherical seated unions shall be used for pipework up to 50mm size and flanges shall be used for pipework 65mm size and above. The flanges shall be flat-faced BS10 Table A if required to connect to equipment having flanges of Imperial size. Otherwise flanges shall be raised face BS4504 Tables 6/2 or 6/5 where the joints are welded and Table 6/4 where the joints are screwed. Flanged joints shall be made with flat ring gaskets suitable for the pressure and temperature and extending to the inside of the bolt circles.
- (3) Screwed fittings other than sockets shall be malleable cast iron, banded or beaded pattern, screwed BSP thread. Standard but welded fittings shall be used on welded pipework.
- (4) Flanges for mild steel pipework shall be forged steel and machines over the raised or flat faces. Headers shall be of flanged mild steel tube with flanges outlets welded on and spare outlets shall be blanked off with bolted flanges.

**4.03** Not Applicable.

**4.04** Not Applicable.

**4.05** Not Applicable. NOTE: Where copper Yorkex tube is used refer to subsequent clauses given in 4.06 which apply to copper tube.

**4.06** DHWS Services  
Not Applicable but where essential modification made to existing :-

- (1) DHWS pipework in mild steel – **Not Applicable.**
- (2) Joints and fittings in mild steel pipework – **Not Applicable.**
- (3) Fittings for copper pipework of up to and including 65mm (2½”) size shall be of the capillary or compression type BS 864 Part 2 by Peglar Yorkshire Group Ltd.  
NOTE : Press-fit system may be used see note below.
- (4) Not Applicable.
- (5) Pipework shall be arranged with adequate connection points to allow easy dismantling. Connection points in copper pipework up to and including 65mm (2½”) size shall be unions.

**NOTE to 4.02 and 4.06:**

**Alternatively**, the Contractor is to use the **Yorkshire Press-fit Xpress ‘copper’ System** in conjunction with Yorkex copper tube or **Xpress ‘carbon’ with carbon steel pipe** but all jointing must be carried out in strict adherence to **Peglar Yorkshire Group Ltd’s** recommendations and using only the properly prescribed jointing equipment.

**This is the preferred method of jointing pipework.**

**4.07 Cold Water Services**

- (1) Copper systems shall be matching to comply with clauses 4.06 (1) to (5) as appropriate, and, as the alternative of Press-fit Xpress fittings. For MDPE or HPPE pipe systems these to be compatible with pipe system and to BS EN 12201 Part 2.
- (5) Pre-cleaning and sterilisation shall be carried out as specified in clauses 5.23.

**4.08 Gas Services**

(1) to (7) Not Applicable.

- (8) Fittings for mild steel pipework inside buildings shall be mild steel or malleable cast iron with taper screwed joints as specified in clause 4.02(1). Jointing material shall be as recommended by the Gas Safety Regulations and Gas Safe Legislative standards.
- (9) Internal pipework shall be arranged for easy dismantling. For this purpose the Contractor shall provide unions at intervals of not more than 24m on pipework up to and including 50mm size and flanges BS10 Table A on pipework over 50mm size where these are to connect to equipment having flanges of Imperial size, otherwise they shall be made with flat ring gaskets suitable for the pressure and extending to the inside of the bolt circles.
- (10) A clearance of 150mm shall be maintained between gas pipes and electric cables, conduits, etc., of internal installations and above ground external installations.

**Additional Note** : Where concealed in wall ducts or ceiling voids these **must** be provided with means of natural free flow air ventilation.

#### **4.09** Oil Flue Lines

Not Applicable.

#### **4.10** General

- (1) All fittings shall, as far as practicable, be the same size as the tubes and pipes connected to them. Bushed outlets will only be accepted if the required outlet size of a fitting is not of standard manufacturer. Eccentric bushings and square tees shall be used where concentric bushings and pitcher tees might cause air to be trapped in the system. Elsewhere square tees shall be confined to dead-leg branches of DHWS systems and on cold water branches to fittings or ranges of fittings.
- (2) Elbows shall be used, where practicable, in preference to bends; square elbows will not be permitted.
- (3) Pipework shall follow the contours of walls and shall be graded to ensure venting and draining. The clearance between pipework (or the lagging) and the wall and any other fixtures shall be not less than 25mm.
- (4) Not Applicable.
- (5) Sets or springs in tubes of 50mm size and above shall be fire-made and the tubes shall remain circular after setting. In galvanised pipework deviations shall be formed from standard fittings.
- (6) Eccentric reducing sockets shall be used where changes of bore are made in runs of nominally horizontal pipework to facilitate air venting and draining.
- (7) Tubes shall be reamed after cuttings and shall be free from burrs, rust, scale and other defects and shall be thoroughly cleaned before erection. See also clause 12.08. Open ends left during the progress of work shall be temporarily closed with purpose-made metal, plastic or wood plugs or caps, or blank metal flanges.
- (8) Joints shall not be made in the thickness of any wall, floor or ceiling and pipework shall not be embedded in the structure of floors unless otherwise instructed by the SO. Where pipework passes through walls, floors or ceilings, sleeves shall be provided. Pipework passing through floors shall be provided with approved type floor and ceiling plates fastened securely to the pipe. The sleeves shall be of the same metal as the pipe.
- (9) All entry and exit holes to or from a building for pipework services shall be sealed and plugged. For service conditions below 60°C the sealant shall be mastic compound; above this temperature it shall be silicone rubber. Where the pipework enters the building through a large hole or duct, a mild steel blanking plate not less than 6mm thick shall be built into the walls of the hole or duct; the service pipes shall pass through clearance sockets welded to the plate and the space between pipe exterior and socket interior shall be sealed and plugged. Where Below ground level use only approved type of water resistant 'Puddle Flange'.

**NOTE:** Alternatively, approved type of fire resistant sealants may be used internally by agreement with SO.

- (10) Return Headers to be welded and set out with valves and fittings to be agreed with PM/SCE before commencing boilers and associated equipment.
- (11) Flow Headers also as (10) above .

## **ADDITIONAL CLAUSES:**

### **PIPEWORK JOINTS AND FITTINGS**

#### **GENERAL POINTS**

##### **General to Copper Pipework**

- (1) Fittings for copper tubing will be of the Peglar Yorkshire 'Press-fit Xpress' type complying with BS EN1254 or British Standard 864 and subsequent amendments. This will apply to all pipes in main vertical ducts. (This applies up to and including 50mm). Alternatively, 'Kuterlite 900' manipulative type fittings complying with BS EN1254 or BS 864 and subsequent amendments may be used at the discretion of the Sub-Contractor except for pipes in main vertical ducts. All fittings on copper services (excluding microbore) to be manufactured by **Peglar Yorkshire Group Ltd.** However, the **preferred** method of jointing is for the Contractor to use the **Yorkshire 'Press-fit' Xpress** copper or carbon jointing method but they must be carried out in strict adherence with the manufacturers recommendations using fittings and tools provided by them.  
In addition, the Contractor will be expected to prove his workman have received the appropriate training in the use of the Press-fit Xpress system.
- (2) All fittings for copper and polythene tube regardless of type of service will be of the **non-dezincifiable type. Dezincifiable fittings will not be permitted on site under any circumstances and proof of compliance to this clause will be required prior to commencement of installation work.**
- (3) The Services Contractor will be responsible for supplying and installing around each service pipes or groups of pipes which pass through a fire compartment wall, ceiling or floor, fire resistant penetration seals as specified in the Schedule of Equipment. Elsewhere where pipes pass through non-fire compartment structures each individual pipe will be oversleeved with copper tube and fitted with Brefco 'Superplates' white polypropylene clip on sealing plates.
- (4) When used all solder used for jointed copper pipes **will be LEAD free.** The use of **ACIDIC** quick cleaning type flux **will NOT be permitted** on this contract.
- (5) The Contractor must survey all existing pipework services entering the plant room or elsewhere to establish duty, sizes etc and advise the Consultant before any pipework is removed or modified.

## **PIPEWORK SUPPORTS, EXPANSION AND ANCHOR POINTS**

- 4.11** Pipework shall be adequately supported in such a manner as to permit free movement due to expansion and contraction. Pipework supports shall be arranged as near as possible to joints and changed in direction. The spacing of the supports shall not exceed the centres given in Tables 1 and 2. Where there are two or more sizes of pipes the common support spacings shall be based on the centres required by the smallest bore pipework.
- 4.13** Vertical rising pipework shall be supported at the base. Branches from risers shall not be used as a means of support for the riser.
- 4.14** Where pipework up to 50mm size is fixed to solid walls, brackets may be of the screw-on or long shank built-in type, except where the walls are plastered when only the long shank built-in type shall be used. Fixing to woodwork and lightweight partitions or walls they shall be screw-on pattern and may be adjustable two-piece type. Brackets for mild steel pipework shall be mild steel or malleable iron; brackets for copper pipework shall be brass or gunmetal. The upper half of the pipe clip shall be detachable without disturbing the fixing.
- 4.15** Brackets screwed to walls shall be secured by expanding plugs or other purpose designed fixing devices; softwood plugs will not be permitted.
- 4.16** Pipework of 65mm size or larger subjected to expansion and contraction and hung from supports shall be suspended on swivel hangers unless otherwise agreed with the SO.
- 4.17** Hangers for horizontal pipework at high level shall be supported from angle or channel irons, supplied by the Contractor, suitable for building-in or otherwise securing to the structure. Adjustable mild steel hangers shall be used. Pipe rings shall be of malleable cast iron or fabricated steel, made in halves and secured by bolts or screws. Alternatively, malleable iron hinged pipe rings may be used, but calliper hooks will not be permitted.
- 4.18** Where pipework is fitted in ducts or trenches or where it is of 65mm size or greater and supported from walls, the design of the pipe supports, guides and anchors shall be as indicated. Where roller supports are required they shall be of an approved type. The preformed insulation shall be kept free of the rolling surface and when in external ducts or trenches insulation shall also comply with clause 10.16(2). Load-bearing insulation at supports, where required, shall be fitted by the Contractor at the time of erecting the pipework.

- 4.19** On mild steel pipework, mild steel anchors capable of resisting the maximum stresses shall be provided and preferably shall be welded to the pipework. Where it is impracticable to weld the anchors to the pipework, cast-iron chairs with at least two wrought-iron stirrup bolts shall be used, the bolts being provided with sufficient thread to ensure an effective grip on the pipe. The Contractor shall supply and fix in position ready for building-in, all cleats, brackets and steelwork secured to the bottoms of ducts or trenches shall be coated with hot-poured bitumen.
- 4.20** Provision for movement due to expansion and contraction shall be made by changes in direction of the pipework, by loops or by special expansion joints approved by the SO. Supports, steadiers and guides shall be arranged to ensure that all movement is taken up by the change in direction of the pipework loop or joint. Where pipework is required to be prestressed for the purpose of reducing expansion stress under working conditions, the extent of the cold pull shall be as indicated.

#### **AIR VENTING**

- 4.22** Devices for air venting shall be provided at high points in the pipework. They shall be installed at the highest points of the sections which they are intended to vent.
- 4.23** Air bottles for LTHW systems shall be made from 50mm size tube, each approximately 230mm long fitted with a cap and 8mm size air cock; they shall be fitted to equal tees and have 50mm size connection if the main is 50mm size or above. Where an air bottle is fixed out of reach an 8mm size extension tube shall be run from the cap to within 1.5m of the floor, terminating with an 8mm size needle-seated key-operated air cock.
- 4.25** Approved type of automatic air vents shall be used where practicable or specifically indicated. They shall have gunmetal or brass bodies, non-ferrous or stainless steel floats and guides, and, non-corrodible valves and seats. Each automatic air vent shall be controlled by a local lock-shield valve. Air release pipes shall be run to discharge at the nearest suitable visible point and as agreed on site with the S.O. The open ends of any air release pipes must discharge in a safe position.
- 4.26** Air venting devices and any air release pipes installed in exposed positions shall be insulated to prevent freezing.

#### **ADDITIONAL CLAUSE:**

Positions of air vents are not generally shown on drawings and therefore must be agreed with the Consultant and **must** always be installed at **high** points on pipework including at the top of risers, and, on all boiler flow and return headers. **Automatic air vents to be Flamco Ltd type Flexvent Top/Super/Max** complete with optional isolating valve shall be used.

## **EMPTYING DOWN AND DRAINAGE**

### **4.27 Heating, Hot and Cold Water Systems**

- (1) Domestic Water and LTHW systems shall be provided at their lowest points with key operated gland cocks having hose unions. Alternatively, the emptying cocks shall be connected in a common drain run visibly to waste.
- (2) Except where specified in Clauses 4.10 (13 and 4.27 (3), 15mm size key-operated cocks with hose unions shall be fitted at all low points of LTHW, DHWS and cold water systems to ensure complete drainage.
- (3) Where a pipe dips under a door into an accessible floor chase/duct a 15mm size plugged outlet shall be fitted to LTHW, DHWS and cold water systems.

### **ADDITIONAL REQUIREMENTS TO SECTION FOUR:**

#### **PIPEWORK**

- (i) Where pipes are to be run between floor or ceiling structures these will be accommodated where necessary in accordance with the Construction Quality Forum ref: CQF M&E detail sheet ME2 April 1997 as published in BSRIA (Not Applicable).
- (ii) **Only metal pipe fixing brackets will be allowed.** Plastic or nylon type clips are **NOT** permitted and Contractor will be required to remove and replace these if used.
- (iii) All pipe fixing brackets for the main heating and primary pipework and domestic water services shall be supported by anti-vibration mountings or other adequate provisions to eliminate the risk of noise or vibration mountings from the pipes to the surrounding structure.
- (iv) The typical arrangement of primary header and associated pipework within the boiler room should be as indicated on working drawings (when issued). The Contractor is to produce working drawings of these requirements which are to be submitted to the PM/SCE for comment before any major work proceeds.

## **SECTION FIVE**

### **CALORIFIERS, CYLINDERS, CISTERNS AND WATER TANKS**

Not Generally Applicable to these works but as when required the specific manufacturer will be referred to in the relevant Particular Specifications.

## **SECTION SIX**

### **SPACE HEATING EQUIPMENT**

Where indicated in the Particular Specifications existing radiators and all associated LTHW distribution pipework will generally be retained and /or modified and will be

fully tested, vented and system inhibitor protection retreated prior to being set back to work. The system will be rebalanced and re-regulated as part of recommissioning undertaken by the Mechanical Contractor.

For details of flushing, cleansing and chemical treatment see later Section 9.18. For replacement or remedial work relating to TRV's refer to the Particular Specification relevant to the Sports Centre site.

**NOTE:**

- a) See also section 12 regarding pre-commissioning cleaning to be carried out by the Mechanical Contractor.
- b) The existing heating systems generally comprises of mild steel pipework usually surface fixed but in some buildings they may be concealed in floor, wall or ceiling ducts, to serve steel panel radiators, natural convectors and some fan assisted convector heaters (copper heat exchangers).

## **SECTION SEVEN**

### **VALVES, TAPS AND COCKS**

#### **SAFETY AND RELIEF VALVES**

**7.01** Safety and relief valves shall be suitable for the operating conditions of the systems and as required by the BS for the boilers or pressure vessels to which they are connected unless otherwise indicated. They shall be of the totally enclosed spring-loaded type with padlock. Safety valves and relief valves shall have a full-bore discharge connections and where any low point occurs in the discharge run it shall be fitted with a 15mm size waste pipe carried clear of the insulation for good drainage. The discharge and waste pipes shall be run to visible safe positions to be agreed with the SO.

#### **PRESSURE REDUCING VALVES**

**7.02** Applicable only as detailed in the Particular Specifications.

**7.03** Applicable only as detailed in the Particular Specifications.

#### **REGULATING AND ISOLATING VALVES, TAPS AND COCKS**

##### **7.04** General

- (1) Where modifications or extensions to existing services are to be carried out all valves which are to be removed and refixed shall, before reuse, be thoroughly overhauled and glands repacked to the satisfaction of the SO, or by agreement replaced.
- (2) The body castings of thermostatic control valves shall be cast gunmetal, bronze or cast iron. The provision of either screwed or flanged ends and other requirements shall be in accordance with clauses 7.05 to 7.07 as appropriate.
- (3) Where indicated, valves shall be lockable.

- (4) Where indicated, isolating valves for LTHW heating systems shall be provided with side pressure tappings having approved connections for attaching a differential pressure indicator.

#### **7.05 LTHW Heating, DHWS and Cold Water Supply Systems**

- (1) Bodies of valves and cocks up to 50 mm size shall be of cast gunmetal or bronze; approved valves having hot pressed bodies may be offered as an alternative. Bodies of valves 65 mm size and larger shall be of cast iron. Castings and pressings shall be of good quality, clean and smooth and free from scale or flaws.
- (2) All working part shall be gunmetal. Holes in covers or in gates for screwed portions of spindles shall have full threads of a length not less than the diameter of the spindle over the threads. Glands shall be machined to provide a running fit between the spindle and the stuffing box. Stuffing boxes shall be properly packed, or fitted with 'O' rings which may be located in plastics bushes.
- (3) Gate valves shall have split or solid wedge gates. Disc valves shall have renewable discs free to rotate on the spindle.
- (4) Valves and cocks in mild steel pipework up to and including 50 mm size shall have taper screwed ends, and of 65 mm size and above shall have flanged ends as specified in clauses 4.02(2) and 4.03(2).
- (5) Wheel valves for heating appliances shall have union ends and either:-
  - (a) Composition hand-wheels shaped to enclose the stem and gland; or
  - (b) Easy clean polished shields and wood or composition hand-wheels.

Both types of hand-wheel shall be secured to the stems.

- (6) Straight pattern valves for heating and DHWS shall be of the fullway gate type; angle valves shall have domed discs designed to offer minimum resistance to flow.
- (7) Lock-shield valves shall have easy clean shields or enclosures to match the inlet valves; two loose keys shall be provided for each size of spindle. Where indicated the lock-shield valves shall have characterised plugs as for regulating valves.
- (8) Regulating valves on circuits shall have characterised plugs and a lockable indicator on the spindle to show the proportional opening.
- (9) Isolating valves shall be of the following types:
  - (a) Fullway gate type for heating, hot and cold water supply systems except for valves with side pressure tappings (clause 7.04(4)) up to 50 mm size which shall be oblique type;
  - (b) Lubricated plug type for hot and cold water supply systems within buildings.

Fullway gate valves shall have metal wheel handles. Wedge gates and all seatings, including the top of the wedge and the associated back seat on the bonnet facing,

shall be accurately machined, or alternatively designed, to provide a back seating. Lubricated plug valves shall have parallel plugs and be arranged for 90° operation with stops on the valve body to limit movement. A ball check valve shall be incorporated in the plug for the retention of lubricant applied under pressure. A spare charge of lubricant shall be provided for each valve.

- (10) Plugs for gland cocks shall be ground-in. A loose key of mild steel forged to shape shall be provided for each gland cock.
- (11) Air cocks shall be nickel or chromium plated, of the spoutless pattern and with screwed taper thread. Two loose keys shall be provided for each installation having up to ten air cocks and one loose key shall be provided for every additional ten air cocks.
- (12) Three way cocks shall be of the 'T' ported type, the position of the ports being clearly grooved on the square end of the plug. A loose key shall be provided for each three way cock.
- (13) Ball float valves shall be of the sizes indicated and shall suit the cisterns specified. Ball float valves for use with feed and expansion cisterns shall be of the long arm type arranged to shut off when the cistern contains 150 mm depth of water. The floats of ball valves shall be of heavy copper with brazed or bronze welded seams and boss, or may be of heavy plastics for cold water cisterns.
- (14) The flaps of non-return valves shall be of light construction and shall pivot on a spindle secured by two phosphor bronze hangers. Each valve shall be fitted with a stop to prevent undue movement of the flap and shall be as silent as possible in operation. The valve shall be constructed so that minimum resistance is offered to gravity flow.

#### **7.06 DHWS and Cold Water Supply Systems**

Generally not applicable except in so far as it relates to those Services within the boiler house:-

- (1) Stop taps and cocks shall be of approved types and located in positions accessible for operation and maintenance.
- (2) Not Applicable refer to Particular specification.
- (3) Not Applicable refer to Particular Specification.
- (4) Not Applicable refer to Particular Specification

#### **7.07 Gas Services**

1. Where indicated, plug cocks shall be fitted in mild steel pipework up to and including 40mm size and fullway gate valves in mild steel pipework 50mm size and above. Cocks and valves for mild steel pipework up to and including 65mm size shall have screwed ends in pipework over 65mm size flanged valves shall be fitted.

2. For copper pipework, cocks and valves as specified in clause 7.08(1) shall be fitted, complete with ends to suit capillary or compression fittings. Valves for 76.1mm tube size and above shall have flanged ends.
3. Cocks shall have cast-iron or gunmetal bodies and gunmetal working parts. Approved cocks with hot-pressed brass bodies may be offered as an alternative. Plugs for cocks shall be ground-in type, with drop handles for sizes up to 10mm and with forged mild steel loose keys for sizes above 10mm.
4. Not applicable.
5. All cocks and valves shall be fitted in accessible positions.
6. Install valves to secondary gas meters as previous clause 2.36
7. A union valve or cock shall be fitted to the outlet side of a primary meter and each side of any secondary meter. A valve or cock shall also be fixed on each main branch to each appliance or boiler.
8. Each secondary gas meter or gas appliance shall be fitted with a suitable pressure governor.

NOTES :

1. Valves for use on all gas pipework will be screwed full bore cocks **Cat No 200M or 201M (flanged)** as manufactured by **Newman-Milliken** part of the Hattersley Group or approved equal.
2. When main gas distribution pipework passes through from the building from one fire compartment to another (vertically or horizontally) or one building to another, local isolating valves must always be fitted and appropriately labelled '**NEW GAS MAIN**'.
3. All new gas boiler houses or where specified in the particular specification and where the main gas meter serves other gas appliances will be fitted with a turbine meter and locked valve by-pass in compliance with the Building Regulations and CIBSE guide GIL65.
4. **Gas Meters**, Refer also to the Particular Specification.
5. Automatic solenoid operated and shut-off valves to be located on all new supplies into the building and also all boiler houses or main kitchens.

## **LABELLING OF VALVES**

**7.08** Every circuit control valve shall be provided with a brass, ivorine, or approved plastics label 75 x 50 mm and 1.6 mm thick, stamped or engraved with a reference number. Wherever practicable the label shall be fixed to the structure in a prominent position to identify the valve concerned.

- 7.09** The Contractor shall provide and fix in a glazed hardwood frame, in a position to be indicated by the SO on site, a plant layout and automatic control diagram showing the positions and numbering of the valves.  
Provide also a separate Gas Line drawing indicating the gas distribution system throughout the Sports Centre.

**ADDITIONAL CLAUSES: VALVES TO APPLY:-**

Clauses **7.04 to 7.06** The following manufacturer and types will be used:-

- (a) **LPHW Heating and Constant Temperature Mains**  
Use **Herz** isolating valves **Stromax – AG** fitted with **0275** drain cock and range up to 80mm, or **Herz 2190** ball valves up to 50mm and 65mm above fully lugged butterfly valves 4219, or, **Oventrop 107 90** ball valves, or, **Oventrop 104 82** butterfly valves. Double regulating/isolating valves will be **Herz Stromax-GM 4217GM** commissioning valve set type fitted with test nipples suitable for 'Perflow' measuring instruments up to 80 mm and **Herz Stromax – MF 4218** (Flanged) cast iron commissioning valve set for 100 mm and above.  
**Herz HVCH25** non-return valves up to 50mm or **Herz HV5153** (CI check valve PN11), or, **Oventrop 107 50**, and 65mm above **Oventrop 107 25** wafer check valves.  
**Herz 4111** Strainers will be up to 50mm (or **Oventrop 112 00**) and Herz 4111 65mm above (or **Oventrop 112 20**).  
**Herz 4119** Drain cocks or **Oventrop 103 33** up to 20 mm, and, **Oventrop 103 20** for 25 mm and over and all valves fitted in plant rooms.
- (b) **General (LPHW)**  
Isolating gate valves will be fitted to all flow pipework, and, double regulating valves to all return pipework as indicated or described. Return pipework between pumps and boilers to be fitted with isolating gate valves. All valves on main branch circuits to risers will be located in accessible positions in the risers, cupboards and in roof spaces. All valves fitted to flow pipework will be provided with red painted handwheels for easy identification. All valves fitted to return pipework will be provided with blue painted handwheels, or, where lockshield type used a 1" diameter blue coloured disc firmly fitted to the valve body.
- (c) **DHWS – Distribution Pipework**  
**Herz WRAS** approved isolating valves or **Oventrop 104 30** and range on flow and **Herz 4011** circuit temperature controller and pasteurisation regulating valve on main return branch circuits except that on all end of circuits **Herz** ball valves, or, **Oventrop 107 90** will be used. Local isolating

valves will be fitted to all taps and/or appliances will be **Herz TMVBV ballofix** chromium plated range, or, **Oventrop 107 93**.

Strainers will be **Oventrop 112 00** and drain cocks **Oventrop 103 35**.

The exact position of all valves to be positioned on site with the PM/SCE agreement as work proceeds.

(d) **Cold Water Mains and Cold water Distribution Pipework**

All mains stop valves are to be to BS 1010: 1959 as manufactured by Yorkshire Fittings Ltd, or, approved equal. All stop valves on the external cold water mains are to be **non-dezincifiable** cast gun metal. **All stop valves** inside the building should be of the loose jumper type and of approved manufacture.

Local isolating valves will be fitted to all final connections to taps, WC cisterns etc, for either mains or tank cold services will be **Herz TMVBV** WRAS approved **ballofix** chromium plated range, or, **Oventrop 107 93**. Strainers will be fig **Oventrop 112 00** and drain cocks **Oventrop 103 35**. Double check valve will be **Brefco 'Prescor DC'** assembly with test point, as manufactured by Brefco (UK) Ltd.

Float valves – not applicable.

**NOTE:** The exact positions of all valves to be agreed on site with the PM/SCE before work proceeds.

The **Herz Stromax** range of valves are all available from Herz Valves UK Ltd, Progress House, Moorfield Point, Moorfield Road, Slyfield Industrial Estate, Guildford, Surrey. GU1 1RU, and, **Oventrop UK Ltd**, Oventrop House, Hatch Industrial Park, Greywell Rd, Basingstoke, Hants. RG34 7NG.

All urinal cisterns to be fitted with 230 volt operated water saving Cisterniser controls and washroom zone water saving controls and water meters (refer to Particular Specification).

**Clauses 7.08 and 7.09**

All valves on the main lateral and rising pipework systems and all items of control equipment, detectors and thermostats to be provided on a framed master circuit chart (location to be agreed). All charts must be properly supported and securely fixed to the wall adjacent to the incoming water supply entry point. In addition, all of the valves on the main pipework throughout are to be labelled using white numbering onto coloured discs as follows:-

LTHW	Red
DHWS	Red with White Stripe
Mains CW	Green
CWDS	Green with White Stripe

### **Valves for Heating Apparatus:**

Thermostatic radiator valves are applicable as required but refer to the Particular Specification. These will be of the types manufactured by Oventrop Valves and/or Herz valves and fitted with vandal proof sensor heads.

Where capillary tubes are used for remote sensors protect tubing with miniature white plastic trunking unless the tube can be inconspicuously concealed.

## **SECTION EIGHT**

### **AUTOMATIC CONTROLS, CUBICLES AND PANELS**

As specified the automatic control panel upgrades and all associated automatic controls will be the responsibility of Specialist HVAC control panel manufacturers Messrs AES Control Systems, 72 Tenter Road, Moulton Park, Northampton, NN3 6AX, Tel No: 01604 790606. These will be constructed and installed in accordance with the PM/SCE requirements.

The supply and installation of these automatic controls and panels **will be carried out by AES under the Mechanical Contract**, including all sub-mains supplies, and whenever specified other remote control field wiring. Refer to the Particular sections of this Specification for details.

## **SECTION NINE**

### **MISCELLANEOUS EQUIPMENT**

#### **THERMOMETERS**

As below or when required as replacement where existing not in good working order – refer to Particular Specifications:-

#### **General**

- (1) A thermometer shall be fitted on each heating return at its point of connection to the main return header (clause 4.10(13), or pipework. Where returns are brought back separately to the boiler a thermometer shall be fitted on each return connection.
- (2) Thermometers shall be positioned so that the sensor elements are truly subjected to the temperature of the water to be measured.

- (3) Right-angle or obtuse-angle thermometers shall be provided for fittings to vertical pipes or vertical faces of cylinders etc, and located in a visible location
- (4) Thermometers fitted more than 2m above the floor shall be of the dial type.
- (5) A thermometer for external air temperature reading shall be supplied and fixed securely in a shaded position outside the boiler house where directed by the SO. The thermometer shall be stem pattern mercury-in-glass or alcohol-in-glass or dial type as indicated:
  - (a) The mercury-in-glass or alcohol-in-glass types shall be mounted on enamelled brass scales graduated from about -20°C to 50°C with wood backings approximately 250 mm long and brass guards over the bulbs. They shall be wholly protected by brass wire mesh semi-cylindrical grid covers.
  - (b) Dial outdoor thermometers shall be generally as specified in clause 9.03 but with a scale graduated from -20°C to 50°C. The outdoor bulbs shall be enclosed in louvered boxes which shall be lockable to prevent unauthorised access and shall be so designed that the bulbs are fully open to the external air.

## **9.02 LTHW Heating Systems**

- (1) Mercury-in-glass, or alcohol-in-glass, thermometers shall be of the wide-bore, lens-magnifying, vertical or angle stem pattern, enclosed in a robust case with base screwed ½" BSP thread, and having a perforated steel tail measuring 75 mm from the underside of the hexagon. The scale shall be boldly marked and shall be graduated from 0°C to 120°C and shall be accurate to plus or minus 1°C over the total range. The scales on thermometers attached to plant shall be approximately 140 mm long and elsewhere approximately 200 mm long, the divisions being at 1°C intervals and numbered at 10°C intervals with bold figures. The cases shall be provided with plain glass duct-proof front. A pocket shall be supplied for each thermometer for insertion into the waterway and shall be filled with sufficient approved heat-conducting medium. The pocket shall be steel, but for copper installations it shall be brass.
- (2) Where dial type thermometers are used they shall be as specified in clause 9.03 but with a scale graduated from 0°C to 120°C.

## **PRESSURE AND ALTITUDE GAUGES**

These will be insertion type and should be combined with temperature gauge whenever possible.

**9.04** Pressure gauges fitted to plant and pipework associated with LTHW systems shall generally comply with BS 1780 Part 2 but shall have dials calibrated both in bar and lb/in<sup>2</sup> from zero to not less than 1 1/3 times and not more than twice the operating pressure. Where fitted on pressure vessels and boilers, the gauges shall be as required by BS 759 with dials not less than 150 mm diameter and with cases of polished brass or chromium-plated mild steel. Where fitted elsewhere, the dials of gauges shall be not less than 100 mm diameter and the cases shall be of polished brass or chromium-plated mild steel or of approved enamelled metal or of plastics. Pressure gauges shall be fitted with lever handle cocks and, where appropriate, siphon pipes.

**9.05** Gauges used solely to indicate the altitude or head and pressure of water shall have dials not less than 100 mm diameter, calibrated both in bar and metres head. In addition to the indicating black pointer, gauges shall be provided with an adjustable red pointer set to indicate the normal working pressure or head of the system. The cases shall be as for the 100 mm diameter pressure gauges specified in clause 9.04. Gauges shall be fitted with level handle cocks.

**Clauses 9.06 to 9.17** Not applicable and **existing gas and water meters to be retained.**

## **WATER TREATMENT**

**9.18** The Tenderer shall include for initially filling the installation after pre-commissioning cleaning (clauses 12.08-12.11), for supplying treated water and supplying and installing additional water treatment equipment as follows:

Charge the installation with mains water only;

### **Additional Clauses:**

- (a) In addition, to clauses 9.18 the Contractor will ensure that all space heating and constant temperature pipework is thoroughly drained and flushed twice through with clean water and/or until clear water obtained before standard Inhibitor at least 5% dilution ratio is finally applied to the cleaned system previously specified. The manufacturers recommendations regarding this treatment is to be strictly adhered to. For purposes of tender allow for up to 150 litres per boiler house of approved inhibitor to be supplied and installed (refer to the Particular Specification).
- (b) All pre-commissioning cleaning, chlorination etc. will be carried out by an approved Specialist to the satisfaction of the Consultant.
- (c) Samples for each cleaned and treated system must be taken after 2 weeks of use and sent to an independent laboratory for analysis and written confirmation that the system has been satisfactorily cleaned and therefore fit for public use. This certification must be inserted in the O&M manual.

### **IMPORTANT NOTE:**

The Contractor must however ensure that sufficient new inhibitor is inserted for his section of the works. Any main boiler house treated water that inadvertently gets drained must also be replaced at the Contractors expense – Contact the existing Maintenance Contractor for details of existing but compatible treatment.

## **SECTION TEN**

### **Thermal Insulation**

#### **IN BOILER HOUSES AND PLANT AREAS**

NOTE : Hammered aluminium casings applied to Kooltherm™ Phenolic insulation with foil faced jacket covering as manufactured by Kingspan Tarec Industrial Insulation Ltd will be installed on all pipe services, low loss headers/dearators unless specifically required to match existing insulation as referred to in the Part III Particular Specification.

**10.01** Thermal insulation in boiler houses and plant room shall be applied to:

- (1) Boilers (except where insulated jackets are provided). NOT APPLICABLE PRE-INSULATED PANELS PROVIDED ON BOILER.
- (2) All pipework carrying hot fluids in circulation, and, also flanges and the bodies of valves in such pipework all sizes – LPHW heating, DHWS and all cold water services within the boiler house or renewed as part of these works.
- (3) Flue piping – This will be integral in the flue construction.

#### **ADDITIONAL CLAUSES:-**

The following Addendum Specification relates to **hammered aluminium** casings applied to **Kooltherm™ Phenolic pipe insulation** with aluminium foil faced jacket covering as manufactured by Kingspan Industrial Insulation Ltd:-

#### **Project Specification: Pipework Services Generally**

##### **A1.0 General**

- 1.1 The Contractor shall include for the supply, delivery and installation of materials necessary for the thermal insulation of systems described in this specification.
- 1.2 The insulation work shall be carried out by a Member of the Thermal Insulation Contractors Association. The thermal insulation specialist shall make himself fully acquainted with all the site conditions and programme of works and shall execute his works within such confines and programme. Reference should be made to BS 5970 as appropriate.
- 1.3 The thermal insulation shall not be applied until the pipework and plant installations have been satisfactorily tested.
- 1.4 Insulation materials and finishes shall be inherently proof against rotting, mould and

fungal growth and attack by vermin, be non-hygroscopic and in all respects be suitable for continuous use throughout the range of operating temperatures and within the environment indicated.

- 1.5 Any work not of acceptable standard shall be removed and replaced at no cost to the contract.
- 1.6 All insulation materials and finishes shall be installed in accordance with the manufacturers recommendations.
- 1.7 No insulation material containing CFC or HCFC components shall be accepted.

## **A2.0** Standard References

- 2.1 The materials, tests, methods of installation etc., shall conform with the following:-

### 2.1.1 British Standards

BS476-6: 1989 - Fire tests on building materials and structures. Method of test for fire propagation for products.

BS476-7: 1997 – Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products.

BS1387: 1985 (1990) – Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads.

BS1710: 1984 (1991) – Specification for identification of pipelines and services.

BS4735: 1974 – Laboratory method of test for assessment of the horizontal burning characteristics of specimens no larger than 150mm x 50mm x 13mm (nominal) of cellular plastics and cellular rubber materials when subjected to a small flame.

BS5422: 2009 – Method of specifying thermal insulating materials for pipes, tanks vessels, ductwork and equipment operating within the temperature range minus 40°C to plus 700°C.

BS6700: 1997 – Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.

BS EN ISO 2286-2: 1998 – Rubber or plastics coated fabrics. Determination of roll characteristics. Methods for determination of total mass per unit area, mass per unit area of coating and mass per unit area of substrate.

BS EN ISO 9001: 2000 – Quality management systems. Requirements.

### 2.1.2 European Standards

EN ISO 9001: 2000 – Quality management systems. Requirements.

### 2.1.3 American Standards

Not Applicable.

### 2.1.4 German Standards

Not Applicable.

### 2.1.5 Other References

- TIMSA Guide  
TIMSA Domestic and Non-Domestic Heating, Cooling and Ventilation Guide
- NES Specification Expert  
Y50 Thermal Insulation
- Defence Estate Organisation Ministry of Defence Specification 036: 1997  
Heating, Hot and Cold Water, Steam and Gas Installations for Buildings

### 2.1.6 Building Regulations/Standards

The Building Regulations 2000 for England and Wales  
Approved Document B 2002 Edition Appendix A12.

#### Scotland

Not Applicable.

#### Northern Ireland

Not Applicable.

#### Irish Republic

Not Applicable.

## **A3.0 Fire Rating of Insulation Materials**

3.1 All insulation materials, adhesives, sealants and facings installed within buildings shall achieve the following standards when tested to:-

BS476-6: 1989 - Of Low Contribution to Fire Growth with Fire Propagation Indices of performance (I) not exceeding 12 and sub-index (i1) not exceeding 6.

BS476-7: 1997 - Of Very Low Surface Spread of Flame (Class 1).

3.2 Insulation systems which meet the required combined standards as detailed above are rated Class 'O'/Low Risk to the Building Regulations/Standards.

3.3 Insulation materials, adhesives, sealants and facings installed on pipework and equipment external to buildings shall be rated as Class 1 when tested to BS476-7:1997.

## **A4.0** Scope of Works

### 4.1 Pipework Systems

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

- (a) Not Applicable.
- (b) Low and medium temperature hot water heating insulated to suit service temperatures.
- (c) Hot water services (non-domestic) insulated to suit service temperatures.
- (d) Cold water services (non-domestic) insulated and vapour sealed.
- (e) Not Applicable.
- (f) 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.

### 4.2 Heat Exchangers, Cylinders and Buffer Tanks

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

- (a) Heat exchangers, hot water cylinders and calorifiers insulated to suit temperature; and
- (b) Chilled water and cold water buffer tanks insulated and vapour sealed.

### 4.3 Internal and External Water Storage Tanks

All tanks shall be provided pre-insulated and vapour sealed.

### 4.4 Valves, Flanges and Unions

4.4.1 Unless otherwise indicated, all fittings shall be insulated to the same thickness and type as insulation on adjacent pipework and also vapour sealed on services operating below ambient temperature.

## **A5.0** Materials

### 5.1 Pipework Systems up to 110°C

- 5.1.1 Insulation shall comprise of 37 kg/m<sup>3</sup> minimum density CFC/HCFC free rigid phenolic foam sections with zero Ozone Depletion Potential (ODP), one metre in length with factory applied fully bonded reinforced aluminium foil vapour barrier jacket.
- 5.1.2 The aged thermal conductivity of the insulant shall not exceed 0.021W/m.K at 10°C mean.
- 5.1.3 The insulation shall be Class 'O'/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.
- 5.1.4 The insulation shall be rigid phenolic insulation, Kooltherm™ FM Pipe Insulation, as manufactured by Kingspan Industrial Insulation Limited.

App. A1 & A4

App. E: Figure E1 & E3

5.1.5 Insulation thickness is to be determined in accordance with the TIMSA Guide BS 5422:2009, from the tables given in App. B and C of this specification.

5.1.6 All pipe supports inserts on pipework operating up to 120°C shall be rigid phenolic insulation, Kooltherm™ Insulated Pipe Supports Inserts designed in accordance with the tables given in App D.

App. A3 & A4

App. E: Figure E4 & E5

## 5.2 Pipework Systems above 110°C

5.2.1 Not Applicable.

5.2.2 In kitchens, food preparation areas, food storage areas or other areas where the use of fibrous materials is restricted, calcium silicate insulations shall be used in place of mineral fibre App A14.

5.2.3 Insulation thickness is to be determined in accordance with the TIMSA Guide/BS 5422: 2009.

## 5.3 Heat Exchangers, Cylinders and Buffer Tanks up to 80°C

Not Applicable to these works.

## 5.4 Heat Exchangers, Cylinders and Buffer Tanks Above 80°C

Insulation shall comprise 75mm thick, 33 kg/m<sup>3</sup> density lamella mineral fibre slabs with a factory applied reinforced foil facing. All corner and straight butt joints shall be sealed with 100mm wide self adhesive aluminium foil tape. App A13.

## 5.5 Internal and External Water Storage Tanks

When supplied to site uninsulated, insulation shall comprise 40mm thick, 40kg/m<sup>3</sup> nominal density CFC/HCFC-free with zero Ozone Depletion Potential (ODP), rigid phenolic insulation boards reinforced with an aluminium foil vapour barrier jacket autohesively bonded to the exposed face and glass fibre autohesively bonded to the inner face during manufacture eg, Kingspan Kooltherm™ FM Duct Insulation or equivalent. All corner and straight butt joints shall be sealed with 100mm wide self-adhesive aluminium foil tape App A5.

## **A6.0** Insulation Finishes

### 6.1 Service Ducts, Ceilings Voids and Floor Voids

Only as relevant :-

6.1.1. Pipe insulation shall be supplied with a factory applied reinforced aluminium foil facing, rated as Class 'O' / Low risk to the Building Regulations/Standards.  
App. A4.

6.1.2 Longitudinal and circumferential butt joints are to be sealed with 50mm wide self-adhesive aluminium foil tape. Support to the sections shall comprise two circumferential bands of self-adhesive aluminium foil tape per section or

alternatively 12mm wide aluminium strappings with matching seals applied as two circumferential bands per section.

App. E: Figure E1

## 6.2 Internal and Exposed to View

### 6.2.1 Specification for pipe insulation will be as detailed in Section 6.1, plus the following finish.

The pipe insulation shall be wrapped with a 170g/m<sup>2</sup> canvas membrane with a water based protective coating eg: Idenden ET-10 or equivalent (App. A6). When fully dried the outer surface of the canvas shall be treated with a second coat in accordance with the manufacturers instructions.

It is essential that the finish is applied to a high standard. An additional acrylic emulsion paint finish shall be an approved BS colour if necessary. App. E Figure E2.

## 6.3 Internal In Plant Rooms and Boiler Houses

### 6.3.1 Specification for pipe insulation will be as detailed in section 6.1 plus the following mechanical protection :

- Insulation to be overcoated with two full applications of Idenden ET-150 coating (App A7) with open weave No 10 glass cloth between coats (App A8); or alternatively
- Insulation to be finished with fabricated sheet aluminium casings 0.6mm thick on pipework up to and including 150mm diameter and 0.8mm thick on pipework over 150mm diameter. Cladding to pipework operating at temperatures below ambient, to be secured with aluminium bands and matching seals at 450mm centres and at circumferential joints which shall be overlapped by a minimum of 40mm. App E: Figure E2.

### 6.3.2 Cladding to hot pipework to be secured with self tapping screws or 'pop' rivets.

### 6.3.3 All flanges and valves in plant rooms shall be fitted with removable boxed, constructed with 0.7mm thick aluminium sheeting lined with equivalent bonded insulation. Boxes shall be secured with 'quick release' clips. On below ambient pipework the vapour barrier shall be maintained by dressing joints with moisture resistant sealant e.g, Foster 95-44 or equivalent. (App A9).

## 6.4 External (Weather Protection)

Specification for pipe insulation will be as detailed in section 6.1 plus the following weather protection :

- Insulation to be overcoated with two full applications to Idenden 30-150 vapour barrier coating (App A10), with No 10 glass cloth between coats (App A8). A solvent based weatherproof mastic e.g, Foster 60-75 (App

A11) or equivalent shall be used in damp and low temperature conditions; or alternatively.

- Insulation shall have a weatherproof coating of minimum 0.8mm thickness polyisobutylene sheeting bonded to the insulation with, minimum 30mm wide circumferential and longitudinal lap joints, which shall be fully solvent welded in accordance with the manufacturers instructions. App E: Figure E2.

## **A7.0** Standards and Workmanship

Refer to foregoing and Particular Specification for type of finish.

- 7.1 Adhesives, sealants and coatings shall be utilised in strict accordance with current recommendations of the supplier, particularly in respect of coverage, drying time, service temperature limits and methods of application.
- 7.2 All pipework shall be insulated with preformed pipe insulation sections with factory applied reinforced aluminium foil finish, rated as Class 'O'/Low risk to the Building Regulations/Standards (App A4). All joints in the foil jacket shall be sealed with 50mm wide self-adhesive aluminium foil tape.
- 7.3 All pipe insulation sections shall be concentric and matched for thickness. No sections have damaged ends or edges shall be used.
- 7.4 Insulation for bends and fittings shall be formed from mitred and trimmed pipe insulation sections, cut to ensure that a good contact with the surface to be insulated is made.
- 7.5 The insulation shall be neatly trimmed with purpose made end caps at pump casings, flange joints, valves and strainers.
- 7.6 The aluminium foil facing shall be continuous at junctions with insulated pipe support inserts with joints sealed.
- 7.7 Under no circumstances shall pipes be married together within the same section of insulating materials.
- 7.8 Care must be taken to ensure the integrity of the vapour barrier is maintained on cold water pipework.
- 7.9 Pipework conveying liquids below 10 deg C shall additionally be fitted with electrical self-regulating trace heating for frost protection.

## **A8.0** Identification of Services

- 8.1 The Contractor shall include for the identification of those services both insulated and uninsulated.
- 8.2 Identification on insulated pipelines shall be by means of BS 1710: 1984 painted non-ferrous colour bands, fastened around the insulation. Directional arrows or other labels denoting flow and return (F&R) where specified, shall be either PVC adhesive tape or painted symbols as agreed with the Consultant.
- 8.3 Colour band identification, and when specified directional arrows and labels, shall be made at:
- a) 3 metres centres on exposed pipework.
  - b) 6 metre centres on concealed pipework.
  - c) Adjacent all valves, changes of direction, inlets and exits to ducts and buildings and at either side of walls and floors.
- 8.4 All arrows used to indicate direction of flow shall be either black or white to contrast with the colour of the insulation finish.

## **A9.0** Frost Protection

- 9.1 Where pipework services are located at roof level or within unheated areas of a building, insulation thickness is to be determined in accordance with BS5422: 2001, from the tables given in App. B : Table B4 of this specification.
- 9.2 Insulation alone will not give adequate protection from frost on static lines subjected to long periods of low temperatures and should be used conjunction with electrical tracing.

## APPENDICES TO SECTION 10

### Appendix A – Materials, Technical data and Information

- A1** Kooltherm™ FM 37 kg/m<sup>3</sup> rigid phenolic insulation (CFC/HCFC – free rigid phenolic insulation with zero Ozone Depletion Potential (ODP) for pipe sections and radiused and bevelled segments).
- A2** Kooltherm™ FM 60 kg/m<sup>3</sup> rigid phenolic insulation (CFC/HCFC – free rigid phenolic insulation with zero Ozone Depletion Potential (ODP) for pipe sections, radiused, bevelled segments and insulated pipe supports inserts).
- A3** Kooltherm™ FM High density 80 and 120 kg/m<sup>3</sup> rigid phenolic insulation (CFC/HCFC – free high density rigid phenolic insulation with zero Ozone Depletion Potential (ODP) for insulated pipe support inserts).
- A4** Aluminium Foil Vapour Barrier Jacket (Glass fibre reinforced aluminium foil).
- A5** Kingspan Kooltherm™ FM Duct Insulation (CFC/HCFC – free rigid phenolic insulation boards with zero Ozone Depletion Potential (ODP) for the insulation of heat exchangers, cylinders and buffer tanks up to 80°C and internal and external water storage tanks). Not Applicable.
- A6** Idenden ET-10 (Protective Coating).
- A7** Idenden ET-15 (Coating).
- A8** No 10 Glass cloth (open weave glass fibre reinforcing membrane for mastics coating and vapour sealants).
- A9** Fosters 95-44 (Moisture Resistant Sealant).
- A10** Idenden 30-150 (Vapour Barrier Coating).
- A11** Fosters 60-75 (Solvent based Weatherproof Mastic).
- A12** 130 kg/ m<sup>3</sup> minimum density mineral fibre pipe sections.
- A13** 33kg/ m<sup>3</sup> lamella mineral fibre slabs.
- A14** Calcium silicate pipe sections.

## **Appendix A1** (Applicable)

Kooltherm™ FM 37 kg/m<sup>3</sup> Rigid Phenolic Insulation for pipe sections and radiused and bevelled segments).

### **Description:**

Kooltherm™ FM 37 kg/m<sup>3</sup> rigid phenolic insulation is CFC/HCFC – free with zero Ozone Depletion Potential (ODP). Its closed cell structure gives the product excellent thermal properties as well as making it highly resistant to moisture penetration and wicking.

Kooltherm™ FM 37 kg/m<sup>3</sup> rigid phenolic insulation can withstand temperatures from -50°C to +110°C. It also has a far superior resistance to burning and spread of flame than that of any other cellular plastic insulation. The composition of Kooltherm™ 37 kg/m<sup>3</sup> is such that when subjected to fire, the outer surface forms a strong carbonaceous layer which retards further flame spread and penetration.

Kooltherm™ FM 37 kg/m<sup>3</sup> rigid phenolic insulation satisfies the requirements of the TIMSA Guide and BS 5422: 2001 in addition, to other major national specifications, including NHS CO<sup>2</sup>, NES Specification Expert Y50, DEO Specification 036 and BS 6700: 1997. Kooltherm™ FM 37kg/m<sup>3</sup> rigid phenolic insulation is manufactured under a quality control system approved to BS EN ISO 9001: 2000 (Quality management systems Requirements).

### **Application:**

Kooltherm™ FM 37 kg/m<sup>3</sup> rigid phenolic insulation has diverse applications especially within the building services industry. While it is primarily used for pipe insulation, Kooltherm™ FM 37 kg/m<sup>3</sup> rigid phenolic insulation can also be used for insulating complex shapes such as vessels.

### **Availability:**

- > Pipe Sections and bends;
- > Radiused and bevelled segments;
- > Slabs: standard slab 2400 x 100mm;
- > Standard and non-standard pipe sizes; and
- > Single layer, multi-layer or rebated joints

### **General Physical Properties**

<b>Property</b>	<b>Test Method</b>	<b>Typical Value</b>
Minimum Density	(ASTM D1622)	37 kg/m <sup>3</sup>
Thermal Conductivity at +10°C Mean Temp	(ASTM C518)	0.025 W/m.K
Colour		Pink
Closed Cell Content	(ASTM D2856 Method B)	≥ 90
Compressive Strength at +23°C	(ASTM D1621)	Minimum 150 kPa
Operating Temperature Limits	Upper Limit Lower Limit	+ 110°C - 50°C

## Fire Test Classifications

Kooltherm™ FM rigid phenolic insulation will achieve the results given below which enables it to be classified by the Building Regulations as being Class 'O' and Low risk by the Building Standards in Scotland.

Fire Test	Test Method	Result
Reaction to fire	EN 13501-1	BL – s1, d0
Surface Burning Characteristics	ASTM E 84	Class A/1
Fire Propagation	BS476-6	Index of performance (I) not exceeding 12 and sub-index (i1) not exceeding 6
Flame Spread	BS476-7	Class 1 *
* These test results combined enable a Class O classification to the Building Regulations in England & Wales, Northern Ireland and the Republic of Ireland, and a low risk classification to the Building Standards in Scotland.		

## Thermal Conductivity Design Values

	Mean Temperature	Typical Value
Thermal Conductivity	+80°C	0.027 W/m.K
	+50°C	0.025 W/m.K
	+10°C	0.025 W/m.K
	0°C	0.021 W/m.K
	-10°C	0.021 W/m.K
	-20°C	0.021 W/m.K

### **APPENDIX A2** - NOT APPLICABLE.

Kooltherm™ FM 60kg/m<sup>3</sup> Rigid Phenolic Insulation (pipe sections, radiused and bevelled segments and insulated pipe supports inserts).

### **APPENDIX A3** - Only As Applicable (Insulated pipe supports inserts)

### **APPENDIX A4** – NOT APPLICABLE.

Aluminium Foil Vapour Barrier Jacket (Glass fibre reinforced aluminium foil).

### **APPENDIX A5**

Kingspan Kooltherm™ FM Duct Insulation  
CFC/HCFC – free rigid phenolic insulation boards with zero Ozone Depletion Potential (ODP) for the insulation of heat exchangers, cylinders and buffer tanks up to 80°C and internal and external water storage tanks.

Refer to : Kingspan Insulation Ltd, Pembridge, Leominster, Herefordshire. HR6 9LA Tel : +44 (0) 1544 388601. [www.kingspaninsulation.co.uk](http://www.kingspaninsulation.co.uk)

### **AND ONLY AS APPROPRIATE THE FOLLOWING :-**

### **APPENDIX A6**

Idenden ET-10 Protective coating

Refer to: Bostik Ltd, Common Road, Stafford, Staffs, ST16 3EH, Tel: 01785 272727 [www.evode.co.uk](http://www.evode.co.uk)

#### **APPENDIX A7**

Idenden ET-150 Coating

Refer to: Bostik Ltd, Common Road, Stafford, Staffs, ST16 3EH, Tel: 01785 272727 [www.evode.co.uk](http://www.evode.co.uk)

#### **APPENDIX A8**

No 10. Glass Cloth

Open weave glass fibre reinforcing membrane for mastics, coatings and vapour sealants.

Refer to: Local insulation distributor

#### **APPENDIX A9**

Fosters 95-44 Moisture resistant sealant

Refer to: Temati (UK) Ltd, Lowmoor Road, Kirkby in Ashfield, Nottingham, NG17 7BE

Tel: 01623 636169 [www.fostereurope.com](http://www.fostereurope.com)

#### **APPENDIX A10**

Idenden 30-150

Vapour barrier coating

Refer to: Bostik Ltd, Common Road, Stafford, Staffs, ST16 3EH, Tel: 01785 272727 [www.evode.co.uk](http://www.evode.co.uk)

#### **APPENDIX A11**

Fosters 95-44

Solvent based weatherproof mastic

Refer to: Temati (UK) Ltd, Lowmoor Road, Kirkby in Ashfield, Nottingham, NG17 7BE

Tel: 01623 636169 [www.fostereurope.com](http://www.fostereurope.com)

#### **APPENDIX A12**

130 kg/m<sup>3</sup> minimum density mineral fibre pipe sections

Refer to: Local mineral fibre manufacturer

#### **APPENDIX A13**

75mm, 33kg/m<sup>3</sup> lamella mineral fibre slabs

Refer to: Local mineral fibre manufacturer

#### **APPENDIX A14**

Calcium silicate pipe sections

Refer to: Local calcium silicate manufacturer

# Recommended Thickness

## Insulation Thickness Table to Control Heat Loss: BS 5422:2009

Steel Pipe Size			Water at 60°C			Water at 75°C		
NB (inches)	NB (mm)	OD (mm)	Kooltherm™ FM max. heat loss		(W/m)	Kooltherm™ FM max. heat loss		(W/m)
			ε=0.05 silver	ε=0.9 black		ε=0.05 silver	ε=0.9 black	
3/8	10	17.2	15	15	6.60	15	15	8.90
1/2	15	21.3	15	20	7.13	15	20	9.28
3/4	20	26.9	15	20	7.83	20	20	10.06
1	25	33.7	20	20	8.62	20	20	11.07
1 1/4	32	42.4	20	20	9.72	20	25	12.30
1 1/2	40	48.3	20	25	10.21	25	25	12.94
2	50	60.3	20	25	11.57	25	25	14.45
2 1/2	65	76.1	25	25	13.09	25	30	16.35
3	80	88.9	25	25	14.58	25	30	17.91
4	100	114.3	25	30	17.20	30	30	20.77
5	125	139.7	25	30	19.65	30	35	23.71
6	150	168.3	25	30	22.31	30	35	26.89
8	200	219.1	30	30	27.52	30	35	32.54
10	250	273.0	30	30	32.40	35	35	38.83

<i>Estimated Mean Temperature of Insulation:</i>	+50°C
<i>Ambient Air Temperature:</i>	+15°C
<i>Surface Emissivity ε (Outer Surface):</i>	0.05 / 0.9
<i>Assumed Thermal Conductivity (k-value) of Kooltherm™ FM 37kg/m³ Insulation:</i>	0.025 W/m·K

Table 1: Indicative Thickness (mm) of Insulation for Non-Domestic Hot Water (60°C) and Low Temperature Heating Service Areas (75°C) to Control Heat Loss

(Based on Non-domestic Building Services Compliance Guide: 2013 Edition, Section 11; TIMSA HVAC Guide Sections 6.2.1 & 6.2.2; and BS 5422:2009 Tables 15 & 18)

## Insulation Thickness Table to Control Heat Loss: ECA & Y50 Enhanced

Steel Pipe Size			Water at 60°C			Water at 75°C		
NB (inches)	NB (mm)	OD (mm)	Kooltherm™ FM max. heat loss			Kooltherm™ FM max. heat loss		
			ε=0.05 silver	ε=0.9 black	(W/m)	ε=0.05 silver	ε=0.9 black	(W/m)
3/8	10	17.2	15	20	6.04	20	20	7.78
1/2	15	21.3	20	20	6.45	20	20	8.42
3/4	20	26.9	20	25	7.00	20	25	9.05
1	25	33.7	25	25	7.71	25	25	9.86
1 1/4	32	42.4	25	25	8.46	25	30	10.83
1 1/2	40	48.3	25	30	9.01	30	30	11.42
2	50	60.3	30	30	9.94	30	35	12.61
2 1/2	65	76.1	30	30	11.25	35	35	14.12
3	80	88.9	30	35	12.17	35	35	15.28
4	100	114.3	35	35	14.29	35	40	17.51
5	125	139.7	35	40	16.09	40	40	19.72
6	150	168.3	35	40	18.24	40	45	22.34
8	200	219.1	35	40	22.06	40	45	26.61
10	250	273.0	40	40	25.95	45	50	30.91

<i>Estimated Mean Temperature of Insulation:</i>	+50°C
<i>Ambient Air Temperature:</i>	+15°C
<i>Surface Emissivity ε (Outer Surface):</i>	0.05 / 0.9
<i>Assumed Thermal Conductivity (k-value) of Kooltherm™ FM 37kg/m³ Insulation:</i>	0.025 W/m·K

Table 2: Indicative Thickness (mm) of Insulation for Non-Domestic Hot Water (60°C) and Low Temperature Heating Service Areas (75°C) to Control Heat Loss

(Based on NES Y50 Enhanced and Enhanced Capital Allowance thickness tables)

## Insulation Thickness Table to Control Heat Gain & Control Condensation

Steel Pipe Size			Water at 0°C			Water at 5°C			Water at 10°C		
			max Kooltherm™ FM heat gain			max Kooltherm™ FM heat gain			max Kooltherm™ FM heat gain		
NB (Inches)	NB (mm)	OD (mm)	z=0.05 silver	z=0.9 black	(W/m)	z=0.05 silver	z=0.9 black	(W/m)	z=0.05 silver	z=0.9 black	(W/m)
3/8	10	17.2	25	20	3.45	20	15	2.97	15	15	2.48
1/2	15	21.3	25	20	3.81	20	15	3.27	15	15	2.72
3/4	20	26.9	25	20	4.18	20	20	3.58	15	15	3.05
1	25	33.7	30	20	4.60	25	20	4.01	20	15	3.41
1 1/4	32	42.4	30	25	5.11	25	20	4.53	20	15	3.86
1 1/2	40	48.3	30	25	5.45	25	20	4.82	20	20	4.11
2	50	60.3	35	25	6.17	25	25	5.48	20	20	4.78
2 1/2	65	76.1	35	30	6.70	30	25	6.30	20	20	5.51
3	80	88.9	40	30	7.77	30	25	6.90	20	20	6.17
4	100	114.3	40	30	9.15	35	25	8.31	25	20	7.28
5	125	139.7	45	30	10.45	35	25	9.49	25	20	8.52
6	150	168.3	45	30	11.86	35	25	10.97	25	20	9.89
8	200	219.1	50	35	14.61	40	30	13.57	30	20	12.27
10	250	273.0	50	35	17.48	40	30	16.28	30	25	14.74
12	300	323.9	55	35	17.48*	40	30	16.28*	30	25	14.74*
14	350	355.6	55	35	17.48*	45	30	16.28*	30	25	14.74*
16	400	406.4	55	35	17.48*	45	30	16.28*	30	25	14.74*
18	450	457.0	60	35	17.48*	45	30	16.28*	35	25	14.74*
20	500	508.0	60	35	17.48*	45	30	16.28*	35	25	14.74*
24	600	610.0	65	35	17.48*	50	30	16.28*	35	25	14.74*

Ambient Air Temperature: +25°C  
 Relative Humidity: 80%  
 Surface Emissivity z (Outer Surface): 0.05 / 0.9  
 Assumed Thermal Conductivity (k-value) of Kooltherm™ FM 37kg/m³ Insulation: 0.025 W/m-K

Table 3: Indicative Thickness (mm) of Insulation required for cold and chilled water supplies to control heat gain and control condensation

\*For pipes and vessels of diameter greater than 273mm, the items shall be assumed to be 273mm for calculation purposes  
 (Based on Non-domestic Building Services Compliance Guide: 2013 Edition, Section 11: TIMSA HVAC Guide Sections 6.2.3 & 7.2; and BS 5422:2009, Tables 6, 8, 10 & 11)

## Insulation Thickness Table to Protect Against Freezing

Steel Pipe Size				Pipe Location	
NB (inches)	NB (mm)	OD (mm)	ID (mm)	Indoor	Outdoor
½	15	21.3	16.0	30	75
¾	20	26.9	21.6	15	30
1	25	33.7	27.2	15	20
1¼	32	42.4	35.9	15	15
1½	40	48.3	41.8	15	15
2	50	60.3	53.0	15	15
2½	65	76.1	68.8	15	15
3	80	88.9	80.8	15	15

Copper Pipe Size		Pipe Location	
NB (mm)	ID (mm)	Indoor	Outdoor
15	13.6	35	130
22	20.2	15	20
28	26.2	15	20
35	32.6	15	15
42	39.6	15	15
54	51.6	15	15
76.1	73.1	15	15
108	105.0	15	15

Ambient Air Temperature – Indoor:	–6°C
Ambient Air Temperature – Outdoor:	–10°C
Initial Water Temperature:	+2°C
Evaluation Period:	12 hours
Permitted Ice Formation:	50%
Assumed Thermal Conductivity (k-value) of Insulation: Kooltherm™ FM	0.025 W/m·K

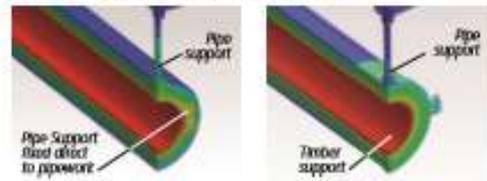
Table 4: Minimum Thickness (mm) of Insulation required to give protection against freezing under specified commercial and institutional conditions  
(based on BS 5422:2009 Table 29)

# Kooltherm™ Insulated Pipe Support Inserts

Kooltherm™ Insulated Pipe Support Inserts are available to suit a full range of pipe diameters and in a full range of insulation thicknesses as shown in the following table; however, special sizes are available on request.

In addition to allowing a continuous vapour barrier on below ambient systems, thermal analysis of a +75°C LTHW system to EN ISO 10211:2007 has shown that Kooltherm® Insulated Pipe Support System can limit heat loss by up to 4x more than rubber lined pipe clips, 5x more than metal pipe clips and 10x more than hardwood pipe support inserts.

## Conventional Pipe Support Methods



**Rubber lined pipe support**  
Thermal analysis\* illustrates heat loss of up to 4 x greater than through the Kooltherm™ Insulated Pipe Support System.

**Timber support insert**  
Thermal analysis\* illustrates significant heat loss of up to 10 x greater than through the Kooltherm™ Insulated Pipe Support System.

\*When analysed in accordance with BS EN ISO 10211: 2007

Load bearing calculations for the standard range of Kooltherm™ Insulated Pipe Support Inserts are based upon the minimum compressive strength of the relevant density and include a safety factor of five. They are designed to support the maximum static compressive loads imposed by horizontal water filled mild steel and copper pipework with hanger supports spaced at the maximum centres shown below. Kooltherm™ Insulated Pipe Support Inserts are not designed to accommodate pipe anchor loads and stresses.

## Steel Pipe

Steel Pipe Size			Kooltherm™ insulated Pipe Support Inserts				
DN (in)	DN (mm)	OD (mm)	Length (mm)	Max. Load (kg)	Spreader Plate (mm)	Support Distance (m)	Density (kg/m³)
½	15	21.3	99	12	none	3	60
¾	20	26.9	99	15	none	3	60
1	25	33.7	99	19	none	3	60
1¼	32	42.4	99	23	none	3	60
1½	40	48.3	99	27	1.0	4	60
2	50	60.3	99	33	1.0	4	60
2½	65	76.1	99	62	1.0	4	80
3	80	88.9	99	73	1.0	4	80
4	100	114.3	99	94	1.0	4	80
5	125	139.7	99	115	1.0	6	80
6	150	168.3	124	410	1.5	6	120
8	200	219.1	124	534	1.5	6	120
10	250	273.0	124	666	1.5	6	120
12	300	323.9	200	1265	2.0	4	120
14	350	355.6	200	1389	2.0	4	120
16	400	406.4	200	1585	2.0	4	120
18	450	457.0	200	1784	2.0	4	120

Values given are based upon Kooltherm™ insulated pipe support inserts with an integral metal spreader plate.



\* Kooltherm™ Insulated Pipe Support Inserts are supplied with a self-adhesive lap. Kooltherm™ FM Pipe Insulation sections should be vapour sealed to the pipe support.

### Copper Pipe

Steel Pipe Size			Kooltherm™ Insulated Pipe Support Inserts				
DN (in)	DN (mm)	OD (mm)	Length (mm)	Max. Load (kg)	Spreader Plate (mm)	Support Distance (m)	Density (kg/m³)
–	–	15	99	9	none	3	60
–	–	22	99	12	none	3	60
–	–	28	99	15	none	3	60
–	–	35	99	19	none	3	60
–	–	42	99	23	none	3	60
–	–	54	99	30	1.0	4	60
–	–	67	99	45	1.0	4	60
–	–	76	99	62	1.0	4	80

Values given are based upon Kooltherm™ Insulated pipe support inserts with an integral metal spreader plate.

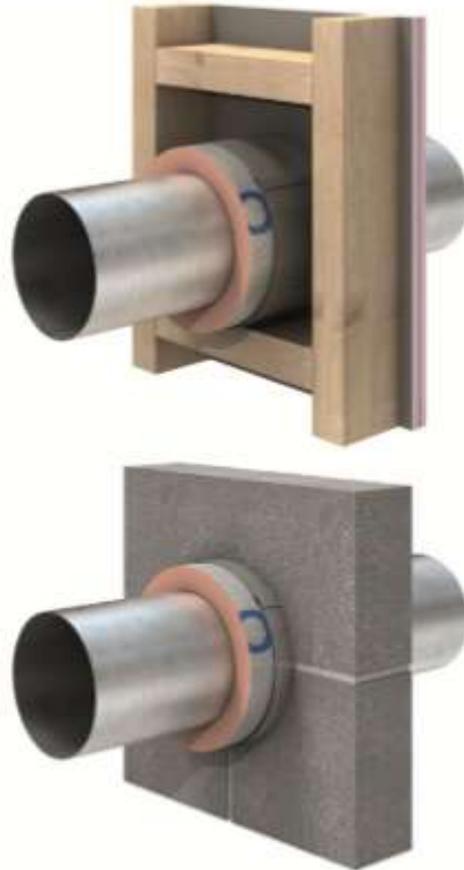
# Kooltherm™ FireSleeve

Kooltherm™ FireSleeves are a unique combination of high performance phenolic insulation, intumescent and stainless steel.

These innovative products act as a 2 hour fire stop to BS EN 1366, on both steel and copper pipe service penetrations through timber frame and block wall applications, and incorporate the excellent fire and smoke performance of Kooltherm™ FM Pipe Insulation.

Kooltherm™ FireSleeves comprise of an outer sleeve of 0.5mm thick stainless steel which is clasp fastening and 205mm in length. It is lined with intumescent material. The stainless steel sleeve, encloses a 300mm length of Kooltherm™ FM Pipe Insulation which is also lined with intumescent material.

Kooltherm™ FireSleeves can be supplied in the following sizes:



## Steel

NB (mm)	20mm thick	25mm thick	30mm thick	35mm thick
15	✓	✓	✓	
20	✓	✓	✓	
25	✓	✓	✓	
32	✓	✓	✓	
40	✓	✓	✓	
50	✓	✓	✓	
65	✓	✓	✓	
80	✓	✓	✓	
100	✓	✓	✓	✓
125	✓	✓	✓	✓
150	✓	✓	✓	✓

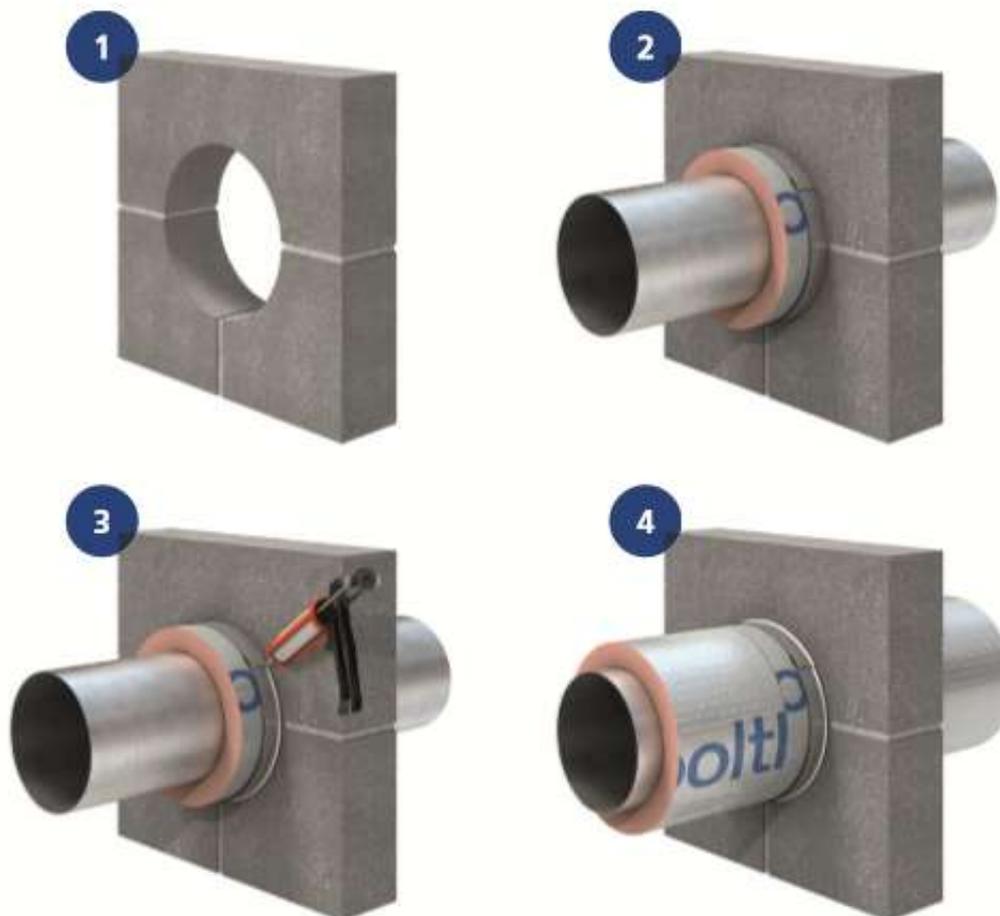
## Copper

NB (mm)	20mm thick	25mm thick	30mm thick
15	✓	✓	✓
22	✓	✓	✓
28	✓	✓	✓
35	✓	✓	✓
42	✓	✓	✓
54	✓	✓	✓

*Kooltherm™ FireSleeves have been tested to BS EN 1366 by BM Trada and receive 120 minutes fire integrity and 60 minutes thermal insulation.*

- Prepare opening in the wall, with minimal disturbance to surrounding structure.
- Open Kooltherm™ FireSleeve and install the 300mm lined Kooltherm™ Insulation onto the pipe. Fit the 205mm stainless steel fire sleeve over the intumescent lined Kooltherm™ FM Pipe Insulation and ensure that the stainless steel clasp is fully engaged.
- Ensure the Kooltherm™ FireSleeve is positioned centrally within the opening.

- Seal any gaps of 5mm or less around the exterior surface of the Kooltherm™ FireSleeve with a 2hr.
- Fire Rated Intumescent Mastic. Large gaps over 5mm should be filled with an appropriate fire rated filler or mortar.
- Install Kooltherm™ FM Pipe Insulation flush to the Kooltherm™ FireSleeve and vapour seal in accordance with the project specification.



## **SECTION ELEVEN**

### **Electrical Equipment and Wiring**

All Electrical wiring installation work associated with new automatic control panel and controls will be carried out by the Controls Specialist Messrs AES Control Systems Ltd and part of the Mechanical Services Contract (See Particular Specification).

#### **11.07 Wiring**

The Electrical wiring system shall be as indicated and shall be in accordance with the relevant extracts of the GGA standard specification for Electrical Services as below.

Listed in Appendix A9

**NOTE:** Heat resistant LSOH insulated single core cables enclosed in galvanised cable trunking and conduit, or, alternatively, FP200 Gold cables all surface fixed to cable tray will be used. FP200 Gold will always be used for wiring all remote equipment which are located outside the boiler house, except where screened cable is indicated in the control schedules.

#### **11.10 Testing**

The Contractor shall supply a Test Certificate for each electrical installation and appropriate items of electrical equipment which are normally subject to tests. The Certificate shall guarantee that the electrical installation or electrical equipment has been fabricated, inspected and satisfactorily tested in accordance with the current 17<sup>th</sup> Edition incorporating latest amendments (2016) of the IEE Regulations for the Electrical Equipment of Buildings and the appropriate British Standard(s) and where possible satisfy the requirements of the **new** 2018 regulations published in July 2018.

## **SECTION TWELVE**

### **Inspection, Tests and Commissioning**

**INSPECTION OF PLANT BY INSURANCE COMPANY. (NOT APPLICABLE)**

### **RESPONSIBILITY FOR REPORTING INFRINGEMENT OF REGULATIONS**

**12.07** Throughout the execution of the works, the Contractor shall be responsible for ensuring compliance with the requirements listed in clauses 1.03 and 1.04 (1) to (6) and shall notify the SO of any infringements which directly or indirectly detract from the safe and satisfactory operation of the installation(s) whether or not such infringements relate to the works covered in this contract or to the associated works of others.

### **PRE-COMMISSIONING CLEANING**

**12.08** Tubes and all items of equipment shall be delivered, stored and maintained in storage with their open ends effectively plugged, capped or sealed. See also clause

1.20. All fittings, valves and sundry items shall be stored in clean bins or bagged and stowed in suitable racks. All such stored items shall be maintained under weatherproofed cover to be supplied by the Contractor until they are ready for incorporation in the works. Particular care shall be taken to ensure that electrical equipment and components are kept clean and dry.

**12.09** Before installations are handed over or subjected to the inspection and tests required in clauses 12.12 to 12.18 the entire installation shall be thoroughly cleaned, both internally and externally.

**12.10** All water installations shall be flushed out with clean water. This shall be preceded by chemical cleaning where indicated. During the flushing out provision shall be made to exclude filters, pumps, meters and any other items of plant which could be damaged by the cleaning operation. The entire operation shall be carried out to the satisfaction of the Services Consultant.

**12.11** Cold water services for domestic use shall, after pre-commissioning cleaning and hydraulic testing, be sterilised by the application of chlorine (clauses 4.07(5) and 5.23).

#### **INSPECTION AND TESTS ON COMPLETION**

**12.12** New pipe systems shall be subjected to a hydraulic test of **1½ times** the maximum working pressure or of **1.4 bar (20 lb/in<sup>2</sup>)**, whichever is the greater, for a period of 30 minutes.

**12.13** Test certificates for works tests required by BS shall be submitted in duplicate to the PM/SCE.

**12.14** On completion of the pre-commissioning cleaning of each LTHW heating installation, domestic water installations, the systems shall be recharged with clean water and then subjected to a hydraulic test of **1½ times** the working pressure for a period of not less than **30 minutes**. Items of equipment, eg: safety valves, bursting discs, set to operate at or below this test pressure shall be isolated or removed prior to applying this test. All welds shall be hammer tested and remain firm. When the installations have been proved pressure tight they shall, as appropriate, be drained and charged with treated water in accordance with clause 9.18.

**12.15** On completion of the pre-commissioning cleaning of each cold water installation, the system shall be recharged with clean water and then tested as follows:- Distributing pipework shall be absolutely watertight under working conditions of pressure with all draw-off taps closed. Water mains and service pipework shall be subjected to a hydraulic test pressure of **90 m head** or **1½ times** the maximum working pressure, whichever is the greater. This pressure shall be maintained without measurable loss for at least **30 minutes**.

**12.16** On completion of each natural gas installation an air pressure test shall be carried out. Service pipework shall be tested to twice the maximum working pressure or to a

pressure of 50 mb (20 in wg), whichever is the greater. Installation pipework shall be tested to a pressure of 30 mb (12 in wg). For pipes up to and including 50mm size the test shall be applied for three minutes. No fall in pressure shall be registered in the readings during the last two minutes of the test. For larger pipes, the test shall be carried out to the requirements of the local Gas Authority. Any component of equipment liable to be damaged by the application of these tests shall first be isolated. A normal working test under design conditions shall then be carried out for a period of not less than six hours.

**12.17** Installations or sections thereof which will be embedded in the structure or concealed in permanently sealed ducts, trenches, roof spaces, etc., shall in addition to the above specified tests be individually tested as they are laid and before being embedded or concealed.

**12.18** All pressure tests as specified above shall be carried out before the application of thermal insulation, but where this would prejudice the completion of the installation the section concerned shall be individually tested before the application of the insulation.

**Additional Note:** For the purposes of clauses 12.12 to 12.16 the Contractor is to assume a normal mains water pressure **3.0 bar**.

## **BOILER COMBUSTION EFFICIENCY TESTS**

**12.19** The Contractor shall include for and arrange for a certified combustion efficiency test to be carried out on each boiler preferably by the boiler manufacturer.

**12.20** For LTHW heating and DHWS boiler plants the Contractor may conduct the tests, provided that he has the necessary experienced staff and instruments available. Alternatively the Contractor shall arrange for the tests to be conducted by a competent independent specialist. The accuracy of all instruments shall be demonstrated.

**12.22** The tests shall demonstrate to the Services Consultant that the combustion efficiency of each boiler is not less than that guaranteed by the Contractor in his tender.

**12.23** The tests required by clause 12.19 shall be carried out in accordance with the following as indicated:

(1) A combustion efficiency test based on flue gas losses taken at the flue gas exit from each boiler. The results of the tests shall be recorded on the Boiler Combustion Efficiency Test Sheet. Failure to demonstrate a satisfactory combustion efficiency (clause 12.22) under this test shall mean application of a full heat balance test as described in clause 12.23 (2) but at the Contractors expense.

(2) A combustion efficiency test will be based on a full heat balance. The test shall be carried out and the report presented in accordance with BS 845. The efficiencies

shall be determined from approximate analysis of the fuel determined by the Contractor through an independent specialist.

- 12.24** Should completion of the works and the readiness to conduct proving tests coincide with a period when difficulty may be experienced in securing operating conditions consistent with eventual design performance, the boiler plant will be provisionally accepted subject to full tests at a later date. This date shall be agreed mutually between the PM/SCE and the Contractor but shall not be later than nine months from the date of provisional acceptance. If the tests at this later date confirm the acceptability of the boiler plant, the completion date, for the purpose of determining commencement of the maintenance period, shall revert to the date of provisional acceptance. If any proving test fails to meet the performance standard specified, the Contractor shall make good the defect at his own cost and the conditions of the contract relating to the maintenance period shall apply to the portions of the works so made good until the expiration of the appropriate maintenance period or the expiration of six months from the date of such making good, whichever is the later.
- 12.25** For all boilers the following requirements of BS 845 shall apply. A period shall be allowed after transfer of load on to the boiler to permit steady state conditions to be reached. For the heat balance tests each boiler shall be separately tested for not less than two hours. To assist in maintaining a steady rate of firing the automatic controls may be rendered inoperative.
- 12.27** When all specified tests have been completed, the test record sheets shall be signed by the Contractor or independent specialist and handed to the Services Consultant.

## **COMMISSIONING**

- 12.28** Each installation shall be fully commissioned. For the purpose of this specification, commissioning shall include the correct adjustment and setting of all plant and equipment, valves, sensors, actuators and other mechanisms, as required, to achieve the design performances indicated by the Authority in the contract documents.
- 12.29** The commissioning procedure shall be undertaken by the Contractor or by a competent independent Commissioning Specialist acting for the Contractor and approved by the PM/SCE. The option shall be as declared by the Tenderer and the sum for Commissioning shall be as stated in the Schedule of tender prices. The PM/SCE reserves the right, at the tender stage, to require an independent Commissioning Specialist to be nominated.
- 12.30** Before any commissioning is started, the Contractor shall ensure that each installation has been cleaned, inspected and pressure tested in accordance with clauses 12.01 to 12.18. The commissioning procedure shall include attendance by the Specialist at the appropriate boiler combustion efficiency test specified in clauses 12.19 to 12.27. The Contractor (or his appointed Specialist) shall also carry out the balancing and regulation of each water distribution system together with the final adjustment of all automatic control systems, to the satisfaction of the PM/SCE.

**12.31** The results of the commissioning shall be recorded by the Contractor (or his appointed Specialist) on the Commissioning Certificate forming part of the contract documents and shall be endorsed by the PM/SCE witness. The items on the Certificate shall be read in conjunction with the appropriate clauses of this specification and the design requirements. The certified results and statements pertaining to the commissioning procedure shall be interpreted accordingly. Where the Commissioning Specialist is required to insert in the Certificate temperatures and other data including the thermal performance of central and sub-plants, the information shall be recorded at the time with the declared external weather conditions.

## **TESTS GENERALLY**

**12.32** Prior notification of all site tests shall be given to the PM/SCE and Client.

**12.33** Fuel, water (other than treated water) and electricity necessary for the operation of the heating and/or hot water service plant, in preliminary runs and for adjustments and tests, and for the application of thermal insulation, will be provided free of cost to the Contractor.

**12.34** The Contractor shall supply all labour, apparatus and instruments necessary for the prescribed tests. The accuracy of the Contractors instruments shall be demonstrated if required.

**12.35** Any defects of workmanship, materials, performance, design of equipment, maladjustments or other irregularities which become apparent during the tests shall be rectified by the Contractor and the tests repeated at the Contractors expense, to the satisfaction of the PM/SCE.

**12(a)** In addition, the Contractor is to allow for separate full system practical operation demonstrations for the Sports Centre and the Client's representative, arranged to suit the handover. These demonstrations will be carried out after commissioning of the works and before handover. Arrangements will be made through the PM/SCE. In addition, the Contractor will produce at these demonstrations for the Clients subsequent use a complete set of operating/maintenance instructions. The above is quite independent of the other requirements of Section 12.

**12(b)** Operating and Maintenance Instructions

To be provided upon completion of the works to suit handover, these shall demonstrate and explain clearly and concisely the operation of the complete plant and installation to the Clients Staff. The Contractor will also provide **two** sets of Operating and Maintenance Instructions in a hard covered binder to form a manual plus 2 copies by CD.

The Manual shall include:-

- (a) Brief outline of the function of the various systems.
- (b) Instructions on routine operation of the systems.

- (c) Details of required maintenance incorporating manufacturers recommendations in respect of frequency of action.
- (d) Details of manufacturers recommendations for lubrication, grease/oils and any special replacements eg: water filters cleaning.
- (e) Details of each item of equipment including manufacturers address, type, model, serial number, duty and rating.
- (f) A duplicate schedule of valves/chart as installed in accordance with clause 7.09 .
- (g) Complete list of 'As Installed' drawings and control wiring diagrams to be read in conjunction with the above.
- (h) The manuals to include all relevant detailed description of associated H&V Controls. Building Log book (refer to Part IB, clause 1.27) to fully comply with Building Regulations Part L2.  
The above manuals shall be handed to the PM/SCE not later than the end of the commissioning period and prior to handover of each phase.

#### **12(c) Ventilation Services**

All existing plant room ventilation systems and associated services are to be inspected/tested and fully re-commissioned generally in accordance with the foregoing and to include Section 15 of M & E Specification No 6 – Mechanical Ventilation in buildings. (Refer also to Particular Specification).

#### **12(d) Commissioning and Setting to Work**

The Contractor is to allow for all the commissioning described in this specification and in compliance with Section 2 of Building Regulations Part L.

The Contractor is strongly advised to employ the services of a Specialist Commissioning Company for the comprehensive final commissioning, regulation, control and setting to work which is required.

The Contractor must allow for this in his tender and to state the name of the Specialist they expect to use which will be subject to review closer to the commissioning stages of the contract.

#### **12(e) Programme Time Allocation for Commissioning and Setting to Work Tests**

In addition, the Commissioning Contractor is to ensure that adequate time allocation is agreed with the Principal Mechanical Contractor for this work to be carried out, and he must state in his tender the amount of time estimated to ensure this work is properly carried out.

The Principal Mechanical Contractor will be required to ensure sufficient time for all tests, commissioning and setting to work is properly accommodated in his main contract programme.

**TABLE 1: SUPPORTS FOR STEEL PIPEWORK**

SIZE OF TUBE	INTERVALS FOR HORIZONTAL RUNS		INTERVALS FOR VERTICAL RUNS, BARE OR
	BARE	LAGGED	LAGGED
mm	m	m	M
15	1.8	1.8	2.4
20	2.4	2.4	3.0
25	2.4	2.4	3.0
32	2.7	2.4	3.0
40	3.0	2.4	3.7
50	3.0	2.4	3.7
65	3.7	3.0	4.6
80	3.7	3.0	4.6
100	4.0	3.0	4.6
125	4.5	3.7	5.5
150	5.5	4.5	5.5
200	8.5	6.0	8.5
250	9.0	6.5	9.0
300	10.0	7.0	10.0

**TABLE 2: SUPPORTS FOR COPPER PIPEWORK**

SIZE OF TUBE	INTERVALS FOR HORIZONTAL RUNS		INTERVALS FOR VERTICAL RUNS, BARE OR
	BARE	LAGGED	LAGGED
mm	m	m	M
15	1.2	1.2	1.8
22	1.2	1.2	1.8
28	1.8	1.5	2.4
35	2.4	1.8	3.0
42	2.4	1.8	3.0
54	2.7	1.8	3.0
65 (2½ in)	3.0	2.4	3.7
76.1	3.0	2.4	3.7
108	3.0	2.4	3.7
133	3.7	3.0	3.7
159	4.5	3.7	3.7

**NOTE:** Copper tube below 15mm and refrigerant pipework services must be continuously supported using cable tray or similar approved method – refer to Particular Specification. Where non-metallic pipework used follow the manufacturers guidance for supports.

**PART III : MECHANICAL SERVICES PARTICULAR SPECIFICATIONS AND SCOPE OF WORKS**  
***REFER TO EACH SEPARATE PARTICULAR SPECIFICATIONS***  
***AND SCOPE OF WORKS***

**1.0 GENERAL**

The particular section of the Mechanical Installation specification is to be read in conjunction with the preceding sections Parts I and II, and in particular the subsequent Schedule and Scope of Work, Rates and Quantities Part III and Appendices.

The work areas will be undertaken in compliance with the Principal Mechanical Contractors programme and sequence of the works for the respective centre and as the Schedule and Scope of Work, Rates and Quantities.

The specific upgrade requirements will be by the Mechanical Services Contractor and who will be responsible for the role of Principal Contractor. They will also carry out all BWIC with services requirements to enable the associated services upgrade works.

The Mechanical Contractor will be responsible for all essential modifications and new installations to the existing mechanical services described and covered the by the Mechanical Services Specification and incorporated in the following Schedule and Scope of Works items which follow for the Sports Centre location.

All work is envisaged to start as soon as possible before the heating season with set up site to be agreed prior commencement of survey/strip out for the main works to continue around normal operation and activities and shutdowns for changeovers and other critical dates are listed in contract particulars towards the end of each Particular Section. The Principal Services Contractor must take all precautions and make all allowances to minimise and avoid wherever possible any inconvenience to the Centre through unnecessary cessation of services in areas which could be affected by these works.

All shutdowns must be carefully co-ordinated to include all sub-trades and will be agreed with the Client before proceeding.

The scope of works as given in respective Particular Specification.

The Mechanical Contractor should note that space is very restricted for the storage of materials on site and therefore wherever possible off-site storage facilities should be adopted as described in the Particular Specification.

Noise restrictions will apply and drilling and noisy activities must be kept to a minimum and by arrangement.

## **Electrical Services Appendix**

### V20 **LV Distribution**

#### V20.1 **Switchgear and Distribution Equipment** (See also Sections Y71)

V20.1.1 Main distribution MCCB panel boards to be from the Eaton Electric Ltd – MEM Memshield 2 range fitted with MEM range of switch disconnectors and MCCB's as manufactured by MEM and as detailed in this specification.

V20.1.2 All new local distribution boards and consumer units will be from Eaton Electric Ltd, Memshield 3 standard range to IP3X standard protection. Distribution boards will be of the sizes/type and ratings as shown and will also be provided with integral isolating switch disconnector as specified.

V20.1.3 All new individual miniature circuit breakers will be from Eaton range of mcb's, RCBO to ICE60898 will have a breaking capacity of up to 15kA and will be of the ratings specified on the drawings or in the relevant section of the specification. Only type B and C will be used (type C only being used to protect individual sub-circuits where fans, pumps or any circuit require motor protection). Where for reasons of safety, individual circuits are specified protected by RCB's of types listed, combined mcb/rcd (single RCBO module) are to be provided suitably rated for the circuit indicated. Unless otherwise stated, for individual circuit protection, only 30mA fault current sensitivity mcb/RCD's will be used.

V20.1.4 All loose distribution equipment will be provided with a system of interconnecting sheet metal cable trunking 150 x 150 mm for linking between the busbar trunking and/or items of witchgear.

#### V20.3 **Sub-Mains: General**

The following section schedules sub-mains distribution and equipment to be provided and installed by the Services Contractor as stated in the Particular Specification:-

V20.3.1 All new mcb distribution boards will be of Eaton Electric Ltd MEM Memshield 3 type A or B manufactured as specified in Particular Specification.

V20.3.2 All new sub-mains cables will generally be as specified and as described in the Particular Specification to terminate at sub-mains distribution panels or distribution boards. Distribution boards are to be fixed to the wall at a height of 2000mm f.f.l. to centre unless otherwise indicated and/or listed in the particular section of this Specification. All new sub-mains cables will be fixed to a system of new perforated galvanised metal cable tray or non-metallic tray as described in section V20.5.1 which are to be routed to ensure adequate physical and electrical separation from adjacent services.

V20.3.3 For rating details of mcb's/mcbo's to be fitted in distribution boards refer to Distribution Board schedules.

#### V20.4 **Sub-Mains Installation**

V20.4.1 For details of all new sub-mains cable and distribution equipment refer to the Particular Specification.

V20.5 Cable Management Systems: Tray, Trunking and Wire Baskets

V20.5.1 Installed Cable Tray/Ladder Systems

The new containment system(s) will be provided and installed along the required route - see Particular Specification and generally these will be one of the following types:-

V20.5.1.1 Along the sub-mains cable routes, as indicated on drawings or described in the Particular Specification, the Electrical Contractor is to provide and install a main system of perforated galvanised light duty return flange cable tray range as manufactured by approved manufacturer. This cable tray will be used for fixing mains voltage sub-mains and sub-circuit cables only and will be complete with all fixtures and fittings. Cables tray will be selected from the following schedule except when the size is otherwise shown:-

**Schedule of Cable Tray Capacity**

<b><u>Type</u></b>	<b><u>w d</u></b>	<b><u>MICV or Similar or XLPE</u></b>	<b><u>Up to 30 mm sq PVC SWA PVC</u></b>	<b><u>70 mm +</u></b>
M4	(100 x 25.4mm) Max No. of cables	6	3	2
M6	(150 x 25.4mm) Max No. of cables	10	5	3
M9	(225 x 25.4mm) Max No. of cables	16	7	5
M12	(300 x 25.4mm) Max No. of cables	20	10	7

For mixed cable sizes select tray using average of each category.

V20.5.1.2 Where cable tray rises from one level to another to independent distribution boards cable tray will be used sized according to the above schedule.

V20.5.1.3 All trays will be directly fixed to the underside of ceiling structures within accessible ceiling voids, and/or, vertical to the walls of service ducts.

V20.5.1.4 All changes of direction will so far as possible be made using the manufacturer's standard fittings, consequently only purpose made on site adaptations will be allowed for particularly difficult changes of direction.

V20.5.1.5 In addition to standard earth bonding links which will be fitted at all joints install equipotential bonding from the main intake marshalled earthing terminal by means of 16mm sq PVC cable (green/yellow coloured) fixed to the cable tray which is to run the entire length of the main cable tray system. Connect this bonding cable to each distribution board which is served by cables fixed to the system of cable tray.

V20.5.2 Installed Cable Trunking

V20.5.2.1 When indicated on drawings or as described in the specification in respect of lighting and power services, the Services Contractor is to provide and install a system of type C standard range of single compartment sheet metal cable trunking complete with lid as manufactured by approved manufacturer. This cable trunking system will distribute as shown on the drawings.

The standard type cable trunking is available in 2m and 3m lengths.

V20.5.2.2 The systems of cable trunkings will be of the sizes shown and will use standard and/or special components

V20.5.2.3 Where any cable duct/trunking passes from one fire compartment to another purpose made fire barriers made from Rockcill resin bonded K fire resistant infill or equal and approved will be used. This will be supplied and installed by the Services Contractor.

V20.5.2.4 Earth bonding links between all joints will generally be provided as described in section V20.5.1.5 for the cable tray. For the standard trunking the bonding link will be required.

V20.5.2.5 The Services Contractor is to allow for all fixings, forming of holes with bushed/grommets slots as necessary. All holes or knockouts will be adequately sealed to prevent ingress of moisture.

V20.5.2.6 All rising trunking is to be adequately fixed using spacer supports to the walls behind or on the soffit.

V20.5.2.7 All sub-mains cables will, after installation, be labelled to indicate their duty with cable sizes indicated and reference to source and final connection, and be secured by means of cable retainers made and supplied by the cable trunking manufacturers. Site made retainers will not be accepted. Where cables trunking rises vertically it shall be fitted with cable grips (pin rack at appropriate centres).

V20.5.3 Installed Standard Cable Wire Basket

V20.5.3.1 When indicated on the drawings or as described in the specification the Services Contractor is to install a system of Cabofil ranges of Fasclac auto electro-zinc plated wire basket and standard accessories, fixings etc as manufactured by Legrand Group. The Fasclac auto system comes complete with various fittings and components to make up the complete system and only these will be installed.

V20.5.3.2 This system will be of the size shown on the drawings or specified and will be used to convey local Communication/Data and Fire Alarm cables only unless otherwise specified.

V20.5.3.3 The wire basket will be installed in accordance with manufacturers instructions only using angle, tees and crossovers as supplied as standard for all junctions and change of direction.

- V20.5.3.4 Each section of wire basket is to be suitably cross bonded to the main earthing terminal of the distribution board for the area. In addition, the correct type of bolted coupling is to be used to ensure reliable earth bonding/continuity.
- V20.5.3.5 Where conduit is specified to protect cables which extend from this system of wire basket then conduit adaptor as appropriate will be used to anchor and support the conduit termination.
- V20.5.3.6 Where containment basket passes through fire separation construction these shall be suitably fire stopped after cable installation completed.
- V20.6 Bonding and Earthing
- V20.6.1 The Services Contractor shall be responsible for ensuring the whole of the electrical installation and all other equipment connected thereto shall be earthed in conformity with BS7671:2008 the 17<sup>th</sup> Edition of the IEE Regulations and all subsequent amendments, and, in addition to the PME requirements of the Supply Authority.  
**Allow where possible for the additional requirements of BS7671:2018 which is published in July 2018 and comes into force January 2019.**
- V20.6.2 Bond to each of the main incoming water or other piped services such as the gas supply with appropriate rated LSOH (LSHF) single core earthing cable from the main earth bar in the electrical intake distribution cubicle or board for the building. All bonding connections to be made using bonding clamps complying to BS951 with conductors being terminated at approved type of glands either by mechanical compression or sweating.
- V20.6.3 Bonding conductors between the distribution board and the earthing terminals provided for each service termination, should so far as practical be continuously looped.
- V20.6.4 The Sub-Contractor should allow for bonding from each distribution board main earthing terminal of each area to all wash hand basins, kitchen and cleaners sinks and stainless steel worktops located in the area using 4.0mm sq PVC insulated single core (green/yellow), or, 2.5mm sq if mechanically protected by conduit in accordance with the IEE regulations.
- V20.6.5 Where sub-mains cables are to be provided these main equipotential conductors are so far as practicable to be provided as integral to the cable using a separate core of the cable (3 core for single phase and 5 core for 3 phase supplies (subject to cable size available)). Individual cables will only be used when specified or cable size is too large for the extra core. Separate conductors are to be strapped to the armoured cable they relate too.
- V20.6.6 N/A
- V20.6.7 From the main electrical intake earthing terminal supply a 50mm sq PVC insulated (green) bonding conductor to the nearest lightning protection down conductor where applicable these are provided to protect the building. All bonding connections shall be

made using only approved types of British Standard bonding clamps as manufactured by Furse or approved equal. In addition, and where applicable the Electrical Company's requirements for P.M.E. installations must be complied with.

V20.6.8 The Electrical Contractor will be responsible for bonding to any extraneous metal such as ventilation ductwork, ventilation hoods, ceiling systems or any similar construction metal deemed to be potential hazard.

V20.6.9 All main earthing bonds will be labelled as appropriate for easy identification.

V21 **General Lighting**

The Contractor is to verify existing circuits and control/switching refer to the Particular Specification and drawings, and:-

V21.1 **General**

V21.1.1 The Electrical Contractor will order and take delivery of all luminaires and install as indicated on the drawings and schedules in the Particular Specification taking cognizance of any changes since Tender.

V21.1.2 Supply and install or modify and extend existing wiring as originally installed with all new additional switches and/or controls shown on the drawings or specified.

V21.1.3 Circuits will be as indicated on the Schedule of distribution board circuit charts designated for each area.

V21.1.4 Where required lighting switches will be of the types listed in the original specification schedule of accessories, mounted in steel boxes and wired in circuits arranged as indicated on the drawings and/or in the schedules.

V21.1.5 Unless otherwise stated, new sub-circuit wiring will be type 6491BS thermosetting LSOH (LSHF) insulated non-sheathed single core insulated cable where required to be concealed in metal conduit flush in the fabric of the building or cables to be enclosed in surface metal conduit and/or FP200 gold cables. **Refer to the Particular Specification.**

The LSOH (LSHF) cable will further be referred to in the specification as 'LSOH/SC' or 'LSHF/SC' (low smoke zero halogen in steel conduits) and these will be as manufactured by Draka UK Ltd, Prysmain Group or equal and approved to BS7211.

Where cables are designated as fire protected serving essential emergency supplies such as standby generator supplies, smoke extract fans, emergency interface control circuits between fire system and ancillary cables these will only be carried out using fire protected cables as clause Y60.1.7.

V21.1.6 When possible conduits will generally be flush mounted and concealed within the fabric of the building expect for sub-stations, switch rooms, plant rooms and general basement areas. Refer to Particular Specification. **Only galvanised or non-metallic conduit will be used when set in chases.**

V21.1.7 The minimum size of any single cable used on this contract will be **1.5mm sq.**

- V21.1.8 At each surface mounted lighting outlet will terminate in a small round galvanised BS conduit box set flush in the ceiling/wall and at wall switches with a standard steel accessory box flush or surface as appropriate to the situation.
- V21.1.9 In potential damp atmosphere will be provided with surface mounted splash proof switches of the type listed in the Schedule of Accessories (Clause Y74).
- V21.1.10 Lighting circuits will be retained except where indicated otherwise.
- NOTE:** **20 amp rated** switches will be used regardless except where reactive dimming is required as these are only available rated 10 amps.
- V21.1.11 N/A.
- V21.1.12 Where appropriate conduits will be concealed within the ceiling structure or suspended ceiling on the underside of the slabs or within roof voids where these occur (refer to Architect drawings for details).
- V21.1.13 Unless otherwise stated switches will be positioned at a height at 1000mm f.f.l. to centre and wall mounted luminaires at f.f.l. to centre and wall mounted luminaires at 2000mm f.f.l. to centre dimension or as otherwise indicated on the Architects setting out details and drawings.
- V21.1.14 Where recessed luminaires are required in suspended or false ceilings, terminate the 'local' wiring adjacent in a 'plug-in' ceiling rose Klick or MK Link connection units mounted in a conduit box. This outlet must be located unfixed immediately adjacent to the cut-out for the recessed luminaires where it will always be readily accessible but, ensuring it does not obstruct the luminaires. Alternatively, multiway lighting control modules can be employed or master control units supplied by luminaire manufacturers instead for serving groups of luminaires under the same control.
- V21.1.15 Complete final connections to recessed luminaires by means of a three core heat resistant flexible core of appropriate rating, or FP200 flex.
- V21.1.16 The exact locations of luminaires should relate to setting out dimensions given on the latest drawings on site before work commences. Clarification must be obtained where any doubt exists otherwise rectification will be at the Contractors cost. The Electrical Contractor will be responsible for providing to the Principal Contractor cut out details to suit the luminaire manufacturers requirements. The Principal Contractor will be responsible for forming these cut outs and any making good which may arise.
- V21.1.17 For details of wall, ceiling and floor finishes refer to drawings and finish schedules.
- V21.1.18 The Services Contractor is to check with luminaire manufacturers to verify the normal fixing arrangements, cable entry positions and fixing methods of any louvre or diffuser attachment to ensure that he provides the appropriate installation facilities. At the same time he must verify in writing all dimensions to ensure luminaires fit the space and not just rely on the drawings or catalogues. NO extra costs will be entertained in this respect.

V21.1.19 Not Applicable.

V22 **General LV Power**

For details of circuit arrangements refer to the particular installation specification and/or layout drawings.

Generally, these will all be wired as follows in V22.1.

V22.1 **General power Outlet (13 amp sockets) Installations**

V22.1.1 From 16, 20 or 32 amp MCB or RCBO's units (as specified) in the existing and for new distribution board serving the area, supply and install LSOH/SC (LSHF/SC) cables in cable trunking or galvanised conduit surface fixed or where practicable concealed in the fabric of the building to each new outlet position as given in the particular Specification or drawings. Alternatively, FP200 gold/flex cable may be used but **refer to Particular Specification.**

V22.1.2 Where areas have false ceilings or voids the cables may be installed surface fixed but concealed from view. Surface conduits will only be permitted where indicated or in workshops, sub-stations, switch rooms or plant rooms. Where a cable trunking or containment system is shown to be provided this will also be fully utilised for accommodating sub-circuit wiring cables.

V22.1.3 At each position terminate at an MK866 and range steel conduit box (flush), or, 899 ALM and range box (surface) fixed to the wall to contain outlets of the type given in the accessory schedule Y74. Generally all outlets will be at heights from f.f.l. to centre as required by the Architects. The exact position of all outlets to be approved

V22.1.4 Socket outlets will be wired as ring circuits only or as indicated in the distribution board schedules. Minimum cable size for ring circuits is 2.5mm sq. Radial circuits will be 2.5mm sq or 4.0mm sq as appropriate. When lengthy runs are involved radial circuits are preferred.

V22.1.5 Equipment provided by the Services Contractor will be connected to the 13 amp switched socket outlets and/or switched neon indicated spur units and wired as part of the nearest ring circuit or radial circuit as appropriate.

V40 **Emergency Lighting**

All new emergency lighting will be wired from the same circuit(s) as the general luminaires. Where this is not required and/or impractical then the following applies:-

V40.1 **General Description**

Where shown on the drawings self-contained emergency lighting will be provided. These may either be separate luminaires, or, emergency control packs usually incorporated within the main luminaires, but sometimes as with small downlighters these could be separate but fitted adjacent. In all instances this will be suitable for 3 hour duration.

V40.1.1 Emergency lighting which is non-maintained (subject to availability of mains supply), including emergency safety lighting which is incorporated in the luminaires or separate self-contained luminaires. From the appropriate mcb's in the local distribution board run 1.5mm sq LSOH/SC (LSHF/SC) or FP200 cables enclosed where necessary within the system of containment or galvanised conduit to each of the non-maintained emergency lighting points show on the drawings. Terminate at each position with a small round high impact grade BS conduit box with FP200 cables to recessed luminaires direct connections may be utilised.

Provide and install emergency luminaires as appropriate to match existing. Where dual-purpose fittings are used, containing a LED/fluorescent mains lamp which operates under normal mains conditions and a self-contained power unit operating a fluorescent/LED lamp in the event of mains failure, each luminaire will require one separate switched supply and another permanent mains supply both wired from the same local circuit.

**NOTE:** Where separate permanent main (24 hour) supplies are installed whenever possible this will comprise of Live and Neutral conductors from the same circuit, otherwise these shall be provided with a warning label inside the luminaires where these are served from a separate mcb and both circuits must be isolated before working on any luminaries.

V40.1.2 Each emergency luminaire or grouped emergency circuit must be provided with a key operated test switch adjacent to or incorporated in the multi-gang grid switch controlling the circuit in the room or area.

**NOTE:** This will not apply where a system of automatic monitoring/testing of emergency lighting is provided (refer to part III specification).

## **SECTION W: COMMUNICATIONS/SECURITY/CONTROL SYSTEMS**

These will apply to new works only:-

### **W10 Telecommunications**

Refer to the Particular Specification and when applicable the Electrical Contractor is to allow for wiring and containment system and other facilities to be provided under this contract. The complete supply, inspection and commissioning of Telecommunication work will be carried out by the Clients Specialist Contractor. All associated work required by the Electrical Contractor must be allowed for as part III of this specification.

### **W12 Public Address/Sound Amplification**

Refer to the Particular Specification.

This work will be undertaken by the Clients Specialist Contractor who will be employed by the Electrical Contractor. Allow all liaison, co-ordination and for organising generally this specialist Contractors work.

- W20            **Radio/TV/CCTV**  
Refer to the Particular Specification and when applicable the Electrical Contractor is responsible for this work. Allow for liaison and co-ordination and for organising generally this specialist Contractors work.
- W30            **Voice and Data Transmission**  
Refer to the Particular Specification Part III and when applicable the Electrical Contractor should allow for:-
- W30.1        **General to Voice and Data**  
The complete supply, installation and commissioning of these Services will be carried out under the Electrical Contract. Allow for liaison and co-ordination with the Clients data Specialist and to employ them to carry out these works. The Specialist will also be responsible for the final connections into all outlets except where otherwise stated in the Particular Specification, and, for providing and installing all associated equipment.
- W40            **Access Control and Monitoring Systems**  
Refer to the Particular Specification.  
This work will be undertaken by the Clients Specialist Contractor who will be employed by the Electrical Contractor. Allow all liaison, co-ordination and for organising generally this specialist Contractors work.
- W41            **Security and Detection**  
W41.1        **General**  
Refer to the Particular Specification. This work will be undertaken by the Clients Specialist Contractor who will be employed by the Electrical Contractor. Allow all liaison, co-ordination and for organising generally this specialist Contractors work.
- W50            **Fire Detection and Alarm**  
W50.1        **General**  
Refer to the Particular Specification. The complete supply, installation and commissioning of Fire Alarm Services will be carried out as part of the Electrical works who will employ the Clients preferred Specialists (refer to Particular Specification) to do this work.
- W50.2        All fire alarm wiring must be completely separate both mechanically and electrically from all other electrical wiring system and use the FP200 gold range of cables.
- W50.3        The system is to be designed to BS5839 and the category type as specified in Particular specification. The system is to be fully addressable with new main control panel, optical smoke detection sensors fitted with addressable base sounders wherever practicable, and, manual break glass units on the fire exit routes. Flashing beacons also to be provided at each sounder location and be integral in base when specified or available.
- W51            **Earthing and Bonding**  
All as Section V20.6 given previously.

W52            **Electrical Contractors co-ordination and liaison with Other Specialists**

The Electrical Contractor must allow for the cost of all liaison and co-ordination with the Principal Contractor and his Sub-Contractors necessary for all of the preceding Electrical Services installations and in addition any direct works specialist employed by the Client. For details of associated electrical works refer to the Particular Specification.

**SECTION Y: SERVICES REFERENCE SPECIFICATION**

Y53            **Control Components**

Y53.1        **H&V Control Panels** - Not applicable other than relocation of existing ventilation controllers as indicated (See Appendix A1)

Y60            **Conduit and Cable Trunking**

Y60.1        **Cables (Standards)**

Y60.1.1     **Only** thermosetting low smoke zero halogen, LSOH (LSHF) insulated non-sheathed single core cables shall be insulated to conform with BS7211 and subsequent amendments manufacturers type ref 6491BS. NOTE: The reference used in this specification for this type of cable will be LSOH/SC or (LSHF/SC).

Y60.1.2     N/A

Y60.1.3     All cables shall be manufactured by Draka UK Ltd, Prysmain Group Industrial Cables or will be of an approved equal.

Y60.1.4     Hituf cables no longer applicable.

Y60.1.5     Except where otherwise specified no cable smaller than 1.5mm sq will be installed. Where 2.5mm sq is specified 7/0.67 stranded cable shall be used. Single strand 2.5mm sq cable will not be installed.

Y60.1.6     Wiring shall be carried out on the 'looping-in' principle. All joints are to be made at main switches, ceiling boxes, socket outlet boxes and distribution boards only. No joints shall be made in joint boxes. The wiring shall be run in the conduits so as not to exceed the recommended normal capacities corresponding manufacturers capacity schedules as facilitated by the I.E.E Regulations (17<sup>th</sup> Edition) BS7671 incorporating amendment 3 including the circuit protective conductors where appropriate.

Y60.1.7     Composite cables required to maintain their integrity under fire conditions will be MICC to BS6207 or, complying with CWZ classifications of BS6387 and low smoke emission such as Pirelli Cables Ltd FP200 'Gold' for surface wiring, direct burial into plaster, tray or other installations requiring dressible cables, or FP200 'Flex' when used in conjunction with cable trunking, conduit or concealed in voids.

All terminations glands etc will be those as recommended by the cable manufacturers as being suitable for the purposes.

Such cables will be separate from any other circuit, and adequately protected from mechanical damage.

**'RED'** NOTE: When used for mains wiring systems **'WHITE'** sheathed cable will be used and sheeting for fire detection or alarm services.

**Y60.2** Galvanised Steel Conduit

**Y60.2.1** All conduit shall be heavy gauge, welded and screwed and shall be protected by galvanised finish and shall conform with BS 4568, Part 1: 1970 (metric) including latest amendments.

No conduit smaller than 20 mm shall be used. The inside surface of erected conduit and fittings shall be smooth and free from burrs and other defects.

**Y60.2.2** Conduit Fittings

All conduit fittings shall conform with BS 4568, Part II 1970 including latest amendments.

No inspection bends nor solid nor inspection tees nor elbows shall be used.

**Y60.2.3** Buried Conduits

When applicable to these works the conduits will be set into chases provided by the Principal Contractor at depths to ensure that the plaster cover provide adequate and secure cover as regulations require.

**Y60.2.4** Conduit Connections

Connections between conduits and sheet steel adaptable boxes, trunking or fluorescent luminaires etc. shall be made by means of a brass hexagonal smooth bore bush fitted inside the box or trunking and connected through a coupling to the conduit.

This method shall also be used when connecting conduit to a cast box not provided with aspout.

**Y60.2.5** Damp, Exposed and Corrosive Situations

In all such situations galvanised conduit and fittings shall be used. Provision shall be made to allow condensed water to drain out. Conduit and fittings shall be painted with black bituminous paint by the Services Contractor.

**Y60.2.6** Surface Conduits

Surface conduits on walls should run horizontally or vertically and when on ceiling should run parallel with the walls. Diagonal runs will not be permitted.

**Y60.2.7** Layout of Boxes and Running Joints

Boxes shall be so spaced that there are not more than two 90° solid bends (or their equivalent) nor more than 9 metres of straight run between them unless approval has been obtained in advance.

Running joints shall be used only where absolutely necessary and permission must be obtained in each case. Running joints shall be painted with red oxide paint as soon as they have been tightened.

**Y60.2.8**     Free Ends

All free ends of conduit shall be fitted with female brass bushes.

**Y60.2.9**     Layout of Conduit Runs

The exact layout and positioning of conduits and accessory boxes including cable draw-in facilities will be discussed and agreed on site before work commences.

Where the Services Contractor proceeds without this agreement the services to be removed and reinstalled in the desired manner, and this will be at the Services Contractors expense.

**Y60.2.10**    Condensation

To eliminate the build-up of moisture from condensation conduit must never drop from one outlet and rise up to another, but must in every case rise up, cross over and then drop down.

**Y60.2.11**    Spare Ways

All spare ways in conduit boxes shall be fitted with brass stopping plugs.

**Y60.2.12**    Multiple Runs

Where two or more lines of conduit follow the same route the distance between them shall not be less than 12mm clear.

**Y60.2.13**    Conduit Fixings

All surface conduits shall be mounted on galvanised spacer bar saddles at not more than 900 mm centres. Each such saddle is to be secured by means of a 32 mm (1.25") countersunk screw in a nylon or other suitable plug of the correct size.

Buried conduits shall be by means of steel pipe hooks driven firmly into dry wood plugs, or the structure and spaced not more than 900 mm apart.

Where fixings have to be made to floor slabs constructed of precast concrete or coffer units, screws into fibre plugs and single fixing saddles will be used. In no circumstances shall hammer or percussion tools be employed in these areas either to make fixing holes or to fix conduits etc.

Conduit concealed in ceiling cavities etc. shall be fixed by spacer-bar saddles fixed not more than 900 mm apart.

**Y60.2.14**    Fixing Surface Conduit for Special Areas

In special areas such as kitchens where strict health or cleaning regimes will be implemented, all surface conduit will be fixed using 'hospital' style raised fixing saddles

to facilitate easy cleaning around the entire conduit system. This will be strictly enforced.

**Y60.3** Flexible Conduit (Standards)

**Y60.3.1** All connections to apparatus which may vibrate and in other cases described in the specification, shall be made by means of flexible retardant nylon conduit **Kopex type LS1** as manufactured by Kem Edwards Ltd, or, equal and approved. In every case their adapters must be used to for all terminations.

**Y60.3.2** In external situations and in locations where it is indicated in the specification. Flexible conduit will be Masterflex Rhino as manufactured by Egatube or equal and approved. The conduit will be terminated by means of adapters in every situation.

**Y60.3.3** In all cases a PVC insulated circuit protective conductor of not less than 2.5 mm sq shall be drawn through these conduits and securely bonded at both ends.

**Y60.4** Non-metallic LSOH (LSHF) Conduit Systems (Standards)

**Y60.4.1** For standard installations or where electromagnetic screening and/or low smoke zero halogen fire protection 3 layer LSOH heavy gauge impact resistant conduit to BS EN 50086 by approved manufacturer to conform to BS En 50086 and BS6099 and will be installed as Y60.7 requirements.

**Y60.4.2** The finish of all conduit and fittings secured to the surface shall always be WHITE otherwise BLACK finish will be used.

**Y60.4.3** All surface conduits and all conduits cast in-situ, in chases, screeds etc. will be heavy gauge. All conduits in suspended ceilings and within hollow partition walls etc. may be light gauge.

**Y60.4.4** The inside surface of all conduits shall be smooth and free from burrs. No inspection not solid fittings shall be used. BS circular junction boxes and adaptable boxes only shall be used.

**Y60.4.5** All MT supertube conduit and fittings shall be plain bored and the method of connection shall be as prescribed by the manufacturer using sealant 20006 for fixed joints and expansion joints.

**Y60.4.6** Conduit connections to adaptable boxes and sheet steel enclosures (eg: fluorescent fittings) shall be made by means of standard adapters, female thread to plain bore, with a screwed male bush fitted inside the enclosure connected into the threaded end of the adapter.

**Y60.4.7** All sets on conduit up to 25mm in diameter shall be formed in accordance with the manufacturer instructions using the correct size of compact tube bender. All bends must conform to the IEE regulations. Sets of conduit above 25mm diameter shall be formed using the appropriate bending equipment and as the manufacturers recommendations.

- Y60.4.8** Not more than 6 metres of conduit shall be installed in a straight run without an expansion coupler being fitted in the run and boxes shall be similarly spaced. This clause will not apply where conduits are cast in situ where it is not necessary to make provisions for expansion.
- Y60.4.9** In damp and corrosive situations provisions will be made to allow condensed water to drain out. Further, all joints shall be treated with an external application of sealant 20006, or, approved equivalent except for expansion joints.
- Y60.4.10** All spare ways in conduit boxes shall be fitted with screwed plugs and the threads shall be treated with solvent adhesive before insertion.
- Y60.4.11** All free ends of conduit shall be fitted with smooth bore bushes.
- Y60.4.12** All surface conduits shall be mounted on spacer bar saddles at not more than those recommended in the IEE regulations and in all cases no more than 1.0 metre on horizontal runs and 1.2 metre on vertical runs. In addition a saddle must be installed 150mm on each side of a bend. Each such saddle is to be secured so that at least 25mm of the fixing screw is embedded in a masonry plug in a material of such strength as to ensure a sound fixing. Such materials are brickwork, concrete, blockwork, structural timber and similar. Fixings must not take place in plaster, lightweight fibre boards and hollow construction without special fixing devices being used.
- Y60.4.13** Not applicable.
- Y60.4.14** No saddle or clip shall be fitted so tightly so as to prevent normal expansion of the tube and allowance shall be made for this when securing conduit.
- Y60.4.15** All non-metallic MT Supertube conduits will be provided with a separate single LSOH insulated circuit protective copper conductor not smaller than 1.5 mm sq throughout the entire system.
- Y60.4.16** Under no circumstances shall the weight of a luminaire be supported solely by a non-metallic conduit box. Either the BS box should be provided with metal inserts or a metal attachment to give increased strength, or additional screw fixings to the ceiling or soffit are to be provided.
- Y60.4.17** Light gauge conduit may only be installed where there is no risk of mechanical damage. The Consulting Engineers approval must be obtained in all cases. Where such a risk exists heavy gauge conduits are to be installed.
- Y60.4.18** The following circuit groups are to be segregated and screened from each other in separate conduits. The segregation and screening is to be continuous and unbroken.
- Y60.4.18.1** Mains Voltage Circuits
- Y60.4.18.2** Fire Alarms Circuits/Class Call System

**Y60.4.18.3** Telephones/Television Distribution

**Y60.4.18.4** Security System Cables

**Y60.4.18.5** Communication, Voice and Data Services

**Y60.5** Steel Cable Trunking (Standard) (See also V20.5.2).

**Y60.5.1** Metal trunking and accessories are to be by approved manufacturer. Where used in humid or damp situations and in all plant rooms containing water services, weatherproof cover with seal will be used. All other special prefabricated lighting trunking will be drawn from the appropriate range by the same manufacturer unless indicated otherwise.

**Y60.5.2** Manufacturers standard trunking, tees, bends and angle accessories etc. are to be used to form a complete trunking system. All bends and fittings will be of the gusset or radius bend type where appropriate.

**Y60.5.3** Standard flanged connector is to be provided to terminate the trunking system and form suitably bushed connections to distribution equipment and apparatus.

**Y60.5.4** All trunking is to run accurately vertically or horizontally.

**Y60.5.5** Surface trunking is to be fixed securely by means of suitable loose bolt steel 'Rawbolts' or non-deteriorating Rawplugs and adequately sized round head screws (galvanised in damp or corrosive situations).

**Y60.5.6** Suspended runs of trunking are to be supported by means of steel brackets of approved design. These brackets will be in grey 'Galvafroid' paint compound or similar and in damp and corrosive areas will be galvanised.

**Y60.5.7** Trunking runs are to be spaced at least 150 mm clear of all Mechanical services.

**Y60.5.8** Trunking passing from one floor level to another, or through a wall separating two fire compartments, to be fitted with fire barriers at the centres of floor slab and/or walls. Fire barriers are to be constructed using purpose made fire barrier units with fire resistant infill material between.

These barriers must extend the full thickness of the wall or floor through which the trunking passes. The Electrical Contractor is to allow for demonstrating to the Fire Authorities the form and nature of these seals and for providing a sample of the infill material for testing.

**Y60.5.9** All internal edges on which cables may rest or with which they may come into contact should be smooth and free from sharp edges so as to avoid any possibility of damage to the cables. Where necessary additional non-metallic bushings or strips shall be provided.

**Y60.5.10** Vertical trunking runs are to be provided with cable support pins at a maximum spacing of 4 metres. Horizontal runs incorporating cables larger than 16 mm sq are to be provided with support pins at a maximum spacing of 2 metres. All trunking mounted

with the lid either at the side or underneath will be provided with cable support straps at not more than 600 mm centres.

**Y60.5.11** Suitable copper earth links are to be provided between all trunking sections. Additional circuit protective conductors may also be necessary to ensure a suitably low earth fault loop impedance and where these are considered necessary they will be specified.

**Y60.5.12** The following circuit groups are to be segregated and screened from each other in separate compartments of compartmented metal trunking. The segregation and screening is to be continuous and unbroken.

**Y60.5.12.1** Mains Voltage Circuits

**Y60.5.12.2** Fire Alarm Circuits/Class Call System

**Y60.5.12.3** Telephones/Television Distribution

**Y60.5.12.4** Security System Cables

**Y60.5.12.5** Communication/Data Services

**Y60.6** Non-metallic Cable Trunking Systems at Skirting or Dado Levels

Applicable only when required by the Particular Specification where the trunking type and manufacturer is detailed.

In all cases the manufacturers' installation instructions will be adhered to.

**Y60.7** Conduits for Special Applications: LSOH OR EMI screening

**Y60.7.1** Where cables are specified and required for special services or those requiring low smoke zero halogen protection or EMI screening such as data, telecommunications signalling and sensitive power services when specified in the particular specification these will be **by approved manufacturer** (See also Y60.4).

**Y60.7.2** The installation of **MT Supertube** will be in strict accordance to the manufacturers' recommendations and advice and for jointing **sealant 20006** will be used.

**Y60.7.3** MT Supertube is a flexible conduit system available in 16mm, 20mm and 25mm O.D sizes single coil length of 100 metres and above (16mm and 20mm) and 50mm and above for 25mm size. The system is also available in 3m lengths. Wherever practicable a continuous length should be used.

**Y60.7.4** **Only** the range of accessories supplied by Marshall Tufflex will be used.

**Y60.7.5** The material is to be cut only using the **20001 tube cutter**, stripped using the **20002 pre-set stripping tool** and bent using the **20003 Compact tube bender**.

**Y60.7.6** Where compliance with **EMC Directive** is required then ref **22063** and range electro-galvanised steel range of boxes will be used. Where **Halogen free** applications dictate then the **21613** range of Halogen free polythene boxes are to be used.

- Y60.7.7** Generally and unless otherwise indicated 'white' covered tube will be used except for fire protection services where **RED** will be used.
- Y60.7.8** A **separate** earth protective conductor is to be drawn into each conduit. **The aluminium is not to be used as an earth protective conductor.**  
Minimum cable size to be used must be equal to phase conductor.
- Y61** **HV/LV Cables and Wiring (MICC)**
- Y61.1** No longer applicable to these works.
- Y61.2** **XLPE insulated, LSHF bedded SWA armoured and LSHF sheathed cables - Copper Conductors**
- Y61.2.1** All such cables used for sub-mains and final sub-circuits within buildings shall be not less than 600/1000 volt grade 90 deg XLPE insulated LSOH bedded, armoured and LSOH sheathed, single steel wired armoured will be manufactured by Draka UK Ltd, Prysmain Group or approved equal and designed for the operating loads and service conditions.
- Y61.2.2** Cables for mains distribution etc. shall be 600/1000 volt grade and the manufacturers reference 694/DLS. In this specification or on design drawings they will be referred to as **XLPE/LSHF/SWA/LSHF**.
- Y61.2.3** All cables shall conform with BS 6724 and subsequent amendments and shall be used for all sizes.
- When specified (up to 70 mm sq) the CPC will be the **5<sup>th</sup>** core of the cable coloured green/yellow. Where the size exceeds **70 mm sq** \* this is only currently available as **4** core cables and therefore a separate type ref BS6491 single core OHLS cable coloured green/yellow CPC of the size specified will be used and this cable will be strapped to the outer sheathing of the main cable to which it serves. \* At the present time.
- Where cables are to be installed underground then XLPE 90 degC range LSHF/SWA/LSHF multicore armoured cables by Draka UK Ltd, Prysmain Group will be used.
- Y61.2.4** Cables will be run in the ducts where these are provided, or surface fixed to cable tray at basement level or rising between floor levels, or laid directly in the ground where shown running externally. The Services Contractor shall be responsible for the correct measurement of the cable length, which must be checked on site before cables are ordered or cut.
- Y61.2.5** Ducts will be provided by the Contractor where cables enter and leave buildings, and elsewhere as required such as road and path crossings.
- Y61.2.6** All cable terminations shall be made by means of mechanical glands supplied by the cable manufacturers and suitable for the intended purpose. Cables glands must be appropriate to the type of atmospheric or other service conditions that may be expected. Each gland shall be fitted with a close fitting shroud.

- Y61.2.7** Each cable shall be supplied in one length. No through joints will be permitted.  
**No underground joints shall be permitted unless otherwise shown.**
- Y61.2.8** Where cables are fixed to walls or to the side of cable ducts they shall be secured by means of suitable hooks and clamps manufactured by Cable Supports Ltd, or equal and approved. Wherever possible the cables shall be fixed below the level of any hot pipes in the same duct. Also, where fixed horizontally in the basement levels the pipes are to be supported on the cable tray system previously specified.
- Y61.2.9** Where cables pass through corrugated black UPVC or similar ducts as required by the Electricity Utilities at entries into buildings, the Services Contractor will be responsible for sealing the ducts at both ends to prevent the ingress of water and vermin. Non-setting compounds manufactured by Messrs 3M plc or 'Densyl' by Winns and Coales are suitable in many cases. The Services Contractor will submit for approval details of his proposals to the Consultants. This requirement will also apply to all ducts containing electrical, Fire alarm systems, data, telephone services, TV and CCTV.
- NOTE:** Under no circumstances will pitch fibre ducts be used to contain electrical cables but only approved black corrugated uPVC tubing will be utilised.
- Y61.2.10** Where cables are laid in external trenches the Contractor will provide the trench, lay a 75mm bed of finely sifted soil or sand on to which the Sub-Contractor will lay the cables. A similar cover will be applied over the cable and the General Contractor will provide and install 'Heptape' electrical cable identification tape along the complete length of the underground cable(s). These tapes will be laid at 200/300 mm below finished ground level. The Sub-Contractor will be responsible for liaison with the Contractor during execution of these works and for ensuring that the trenches, bedding and coverings are properly formed. Where the Sub-Contractor is not satisfied with the facilities the Contractor has provided he must immediately bring this to the attention of the Consulting Engineers. Work will also be immediately suspended pending inspection.
- Y61.3** Paper Insulated, Lead Covered and Steel Wire Armoured (P.I.L.C)  
Not Applicable To These Works.
- Y61.4** Wiring by means of PVC Insulated and Sheathed Twin and Earth, or, OHLS Low Smoke Zero Halogen Cables  
Not applicable to these works.
- Y61.5** Wiring by means of 'Hituf' Insulated and Sheathed Cables (600/100 volt grade)  
Not applicable to these works.
- Y63** **Support Components - Cables**
- Y63.1** Cables will be run in the positions indicated on the approved design and installation drawings.
- Y63.2** Where cables are run fixed to the structure or in vertical ducts they shall be supported by proprietary metal cable clamps and brackets as manufactured by Messrs Cable

Supports Ltd or equal and approved. These cleats will be of the correct size for the loads imposed on them without distortion or twisting.

**Y63.3** Cables will be supported at the centres recommended in the IEE Regulations and the cable manufacturers recommendations.

**Y63.4** Multiple cable runs will be supported by means of cable tray, basket or ladder systems as required for the design and described in sections of this Specification. In these cases the cables will be supported by means of cable clamps for all vertical runs and by means of cable ties for horizontal runs where the cables are above supporting medium. Metal wire baskets will generally only be used for communication and IT cable systems.

**Y63.5** The Services Contractor shall include for all design and installation work associated with fixing cable supports to the structure such as cast in fixings etc.

**Y71** **LV Switchgear and Distribution Boards**

**Y71.1** Care of Switch Panels, Distribution Panels and Control Panels

**Y71.1.1** The Electrical Contractor shall be responsible for arranging the exact date and time of delivery of such panels with the manufacturer and shall also afford every assistance in off-loading all such equipment.

**Y71.1.2** The Sub-Contractor shall arrange for suitable storage for any panel that is not able to be positioned immediately.

**Y71.1.3** In addition, all panels which have been positioned within the building shall be fully protected against adverse weather, against the ingress of water or dust or cement and form mechanical damage.

**Y71.1.4** The standard of the final finish of all panels and their components both externally and internally at the completion of the contract shall not be less than when the panels were delivered to site.

**Y71.1.5** The Sub-Contractor shall notify the Consulting Engineers when the panels are delivered in order that an inspection may be carried out.

**Y71.1.6** The Sub-Contractor shall be responsible for checking all internal connections and shall confirm to the Consulting Engineers that each panel has been properly constructed.  
**To avoid any possible delays in the event of a defect being discovered it is suggested that this checking procedure should be carried out as soon as the panel is delivered to site or to the Sub-Contractors stores.**

**Y71.2** Switchgear (Standards)

**Y71.2.1** All new switchgear and panel boards shall be manufactured by Eaton Electric UK (MEM) and the construction of each individual panel shall be such that all components shall be selected for standardisation. Refer to Particular Specification for details.

- Y71.2.2** All switchboards, control panels and motor controls will comply with the requirements of BS 5486 part I and EN60439-1 (IEC439-1) with environmental protection to IP41 (IP4X).
- Y71.2.3** Switchboards will be positioned so that the access to operate equipment is not obstructed. Access to the rear, where this is required for maintenance, will be adequate. In most cases this access will be at least 900mm wide and 1800mm high.
- Y71.2.4** Where a switchboard incorporates rack out switchgear, the switchgear shall be so positioned so that there is at least a 900mm passage way when the equipment is in the fully racked out position.
- Y71.2.5** All apparatus shall be so placed on a switchboard that there is ample room for its safe and effective operation and handling.
- Y71.2.6** The maximum height of any operating controls shall not exceed 1800mm above finished floor level and the minimum shall not be less than 400mm.
- Y71.2.7** Each section shall be fitted with a demountable undrilled metal gland plate (except where glands are provided with the panel when the plate will be drilled) with adequate space to terminate the cables/conduits etc. Each plate will be earthed by means of a separate conductor connection back to the panel earthing system. Where single core cables are used the gland plate must be of non-ferrous material.
- Y71.2.8** All lifting eyes supplied with the board will be removable and replaced by chrome plated bolts.
- Y71.2.9** The Electrical contractor must submit drawings of all switchgear cubicles or assemblies for approval to the Consulting Engineers.
- Y71.2.10** All switchgear/panels shall be constructed in modular form. The panel will be of steel and all components will be plated, primed and finished with stoved epoxy powder coloured light blue.
- Y71.2.11** All switchpanels will be fully vermin proofed. This proofing must be such that its effectiveness is not lost when cable are installed.
- Y71.2.12** Compartments will be easily accessible for maintenance purposes. Barriers will be fitted between each compartment to ensure safe maintenance on any outgoing circuit while the rest of the board is electrically energised.
- Y71.2.13** It must be possible to extend any switchgear at either end by bolting on additional modules/sections.
- Y71.2.14** All live terminals on doors will be insulated and screened. All doors and hinged covers will be earthed. The doors must be restrained to prevent them opening beyond 120 degrees. Earth or other conductors must not function as restraints.

- Y71.2.15** Terminals for all outgoing circuits must be provided, direct connection into switchfuses distribution boards is not acceptable.
- Y71.2.16** Switchpanels and panels will all be provided complete with:-
- Y71.2.16.1** All interconnections and fixed internal wiring.
  - Y71.2.16.2** Labels of multi layer plastic fixed with chrome plated screws and engraved with 8mm black letters on a white background (Traffolite).
  - Y71.2.16.3** Copper busbars.
  - Y71.2.16.4** Phase indicators.
  - Y71.2.16.5** Fuse/mcb charts.
  - Y71.2.16.6** Warning labels of voltage, need to isolate before opening and warning of any remote supplies to each panel.
  - Y71.2.16.7** Label showing the names and addresses of the Sub-Contractor and the Consulting Engineer.
  - Y71.2.16.8** Switches and isolators all fitted with the means of locking off.
- Y71.2.17** A continuous tinned copper earth bar will run internally the length of the switchboard with terminals to connect to the earthing system. The cross sectional area of this bar will not be less than that required by the IEE Regulations and the number of terminals ways will be twice the items of switchgear on the panel.
- NOTE :** When the supply company require a fully marshalled earth terminal block at top of cubicle or switchpanel in clear and accessible location this will be provided during manufacturer.
- Y71.2.18** In main electrical intake rooms the Electrical Contractor is to supply and install standard Electric Shock notices, and, an approved type of rubber mat(s) for the working area in front of each cubicle.

**Y73** **New Luminaries and Lamps**

**Y73.1** General

- Y73.1.1** All new Luceco LED luminaires are to be supplied and installed complete with all lamps of the sizes shown and light control devices as described herein, or on the drawings. The Electrical Contractor will allow to install them in the positions shown on the drawings.
- Y73.1.2** N/A.
- Y73.1.3** N/A
- Y73.1.4** All LED luminaires to be complete with lamps, all drivers and associated control equipment as specified.
- Y73.1.5** Refer to Particular Specification for special mode of operating/controlling luminaires, such as dimming, daylight, occupancy or self-monitoring and testing provisions for luminaires with emergency lighting facilities.

**SCHEDULE OF NEW LUMINAIRES** (See Particular Specification)

**Y74** Accessories for Electrical Services

**Y74.1** The following general MK references will apply to single phase accessories included in this and all other section of the specification except where otherwise specifically described or specified with special finish in the Particular section of this specification :-

AREAS	SERVICE	SINGLE/TWIN FLUSH (OFFICE AREAS)	SINGLE/TWIN SURFACE (WAREHOUSE/TANNERY or WORKSHOP/TESTING LABORATORY)
General	13A S.S.O	K2757WH1/ K2747WH1 or K2746WH1 *	As flush but from the Metalclad Plus range
General	13A Spur	K1040WH1	As flush but from the Metalclad Plus range
General	13A Spur and Flex Outlet	K1070WH1	As flush but from the Metalclad Plus range
General	Flex Outlet	K1090WH1	As flush but from the Metalclad Plus range
General	Light Switches	K4871WH1 and range For multi-gang use white grid plus range with 10 or 20 amp switches as required	As flush but from the Metalclad Plus range
AREAS	SERVICE	SINGLE/TWIN FLUSH (OFFICE AREAS)	SINGLE/TWIN SURFACE (WAREHOUSE/ WORKSHOP)
General Dimming control	Reactive	Grid Plus K4900 WH1	As flush but from the Metalclad Plus range
Kitchen/Workshops/Servery	13A S.S.O	2958MCO / 2948 MCO	As flush but from the Metalclad Plus range
Kitchen/Workshops/Servery	13A Spur and Flex	971 MCO	As flush but from the Metalclad Plus range
Kitchen/Workshops/Servery	Light Switch/ multi-gang	Grid Plus range MCO with 10 or 20 amp switches as required	As flush but from the Metalclad Plus range
Emergency key/ Test switch	Light switch	Grid Plus K4917 EL WH1 (DP)	
<b>Special Areas</b>			* Workshops only – flush in Kitchens
High Humidity or Plant Rooms	13A S.S.O	--	56301Masterseal with RCD Protection
High Humidity or Plant Rooms	Light Switches	--	Masterseal range (surface)
<b>Special</b>			
Clean Supplies for IT	13A S.S.O	K1257WH1 / K1246WH1	As flush but from the

equipment			Metalclad Plus range
Bathrooms/Toilets	Pull Cord Switch	3191WH1 (1 way)	As flush
Cooker	Control Unit/Flex Outlet	K5215CKWH1 / K5045WH1	As flush but from the Metalclad Plus range
Medium Rated Fixed Appliance (4 kw)	Control Switch 20A	K5105WH1	As flush but from the Metalclad Plus range
High Rated Fixed Appliance (4 to 9 kw)	Control Switch 45A	K5205WH1	As flush but from the Metalclad Plus range
<b><u>RCD Protected</u></b>			As flush but from the Metalclad Plus range
General	13A Twin S.S.O	K6233 (Passive)	As flush but from the Metalclad Plus range
Kitchen	13A Single S.S.O	K6304MCO (Passive)	<u>Flush</u> required

\* Applies always where dual earth terminals required for IT services (K2757WH1 already fitted with high integrity earthing).

**NOTE** : All small power outlets and lighting switches to be provided with **different colour surrounds** or faceplate colour to help distinguish them to comply with DDA regulations – refer to Part 3 Particular Specification.

#### **Y74.2** Connector units for recessed or concealed luminaires including pelmets and similar

Ashley Rock Klick Lighting 4 or MK Link range of single or multi outlet white distribution units fixed within a suitable metal box or containment. **NOTE:** For emergency lighting will use 4 pole versions to accommodate 2 separate mains supplies.

Alternatively, where multi-function lighting switching controls are to be utilised the Flex 7 multi-way lighting control modules (LCM) may be used as manufactured by Messrs Flex Connectors Co Ltd, or, equal and approved.

#### **Y74.3** Small Power Single and Three Phase supplies – Local Isolation

For local isolation of large power equipment use MEM RDMP range rated 20 to 63 amp thermoplastic moulded rotary isolators to IP65 standard provided complete with appropriate padlock for locking in the 'OFF' position.

Regardless of duty the rating of the isolator selected will be 2 times the equipment connected loads. RDMP isolators are available in nominal ratings 20A, 25A, 40A and 63 amp and configured 4P or 8P. The isolator will be provided with a label inscribed for the duty / equipment it serves.

#### **Y74.4** Communication/Data/Telephone outlets

These will be provided and installed by the Clients Specialist Contractors responsible for these installations.

**Y75**      **Heights of Accessories**

Unless otherwise stated accessories will all be fixed to a standard MK steel accessory (Flush) or WHI (Surface) box and all will be flush or surface mounted, as appropriate, installed at heights to comply with Building Regulations and the requirements for disabled persons:-

**NOTES TO Y75:**

- (1) **Exact heights must always be checked and verified on site and agreed with reference to the setting out drawings/details or requirements.**
- (2) Where outlets are shown adjacent to each other such as S.S.O, data, telephone and TV then these will all be at the same height with an appropriate spacing between.
- (3) Metal clad accessories surface mounted will only apply to plant or general workshop/warehouse areas.

**Y80**      **Earthing and Bonding Components**

All equipment used for earthing and bonding will be in accordance with British Standards IEE Regulation, and the supply company and suitable for the purpose and location.

**Y81**      **Testing and Commissioning of Services Installations**

**Y81.1**      Prior to handover, phased or otherwise, the Services Contractor will set to work, test and commission the whole of the new installation. This will be done to the satisfaction of the Consulting Engineer. The tests carried out at works must be offered for witnessing by the Consulting Engineer or his representative, in conjunction with the Services Clerk of Works where one is appointed.

**Y81.2**      The testing of the installation will be carried out according the latest requirement of the BS7671:2008 Wiring Regulations incorporating amendment 3 and according to appropriate British Standards and Codes of Practice. Inspection certificates as BS7679:2008 and 2018 Regulations must be completed and submitted together with certificates for any other parts of the installation. The relevant BS and standard forms/test certificates are required using the National Inspection Council for Electrical Installation Contracting forms as available.

**NOTE:**      Where **partial or phased handover** is applicable to the works the Services Contractor must issue a provisional test/completion certificate at each stage with an overall completion certificate being provided at the end of the contract installation completion.

**Y81.3**      The Clients Engineer and Consulting Engineer will be offered the opportunity to witness the following tests and the Electrical Contractor must provide the necessary instrumentation, tools and personnel to enable this to be carried out:-

- |                |  |
|----------------|--|
| <b>Y81.3.1</b> | Continuity of all conductors.                      |
| <b>Y81.3.2</b> | Conductor resistance.                              |
| <b>Y81.3.3</b> | Insulation resistance of all cables and equipment. |
| <b>Y81.3.4</b> | Polarity of all circuits.                          |

- Y81.3.5** Phase rotation for all three phase supplies.
- Y81.3.6** Earth loop impedance of all final circuits.
- Y81.3.7** Polarity of all circuits.
- Y81.3.8** HV tests to HV equipment and cables.
- Y81.3.9** Disconnection tests for all RCD protective devices.
- Y81.3.10** Correct functioning of equipment.
- Y81.3.11** Emergency lighting installation and luminaires.

**Y81.4** Test certificates are also required as follows:-

**Y81.4.1** Specialist Installations

All direct works specialists will be responsible for carrying out full testing and commissioning of their installations except where specified specifically for the Electrical Contractor to undertake as part of his testing/setting to work programme.

**NOTE:** 1 copy of the final test certificates for each installation must also be inserted into each copy of the O+M manuals and copied onto CD.

**Y81.5** Physical Inspection

The Electrical Contractor is to formally confirm in writing to the Consultant when the installation is complete, with all equipment securely fixed and services identification markings in place and all colour codes correct.

**Y81.6** Settings and Adjustments

The Electrical Contractor must set all protective and control devices and time switches within maximum and minimum settings as the design necessitates, or, in the case of time controls to suit the Clients requirements.

**Y81.7** Conductive Parts

The Electrical Contractor must test that all conductive parts throughout the building which are simultaneously accessible with exposed extraneous conductive parts.

Test to ensure that conductive parts which are not extraneous conductive parts are separated from earth by an impedance greater than 50,000 ohms or as otherwise specified.

Test to ensure that other conductive parts are bonded to the equipotential zone earth bar by an impedance not to exceed 0.1 ohms.

**Y82** Identification – Electrical

**Y82.1** Cables and conduits etc. will be clearly identified in accordance with 17<sup>th</sup> Edition IEE Regulations 2008 and 2018 where relevant and will adopt the colour system and defined in regulation 514 and Table 51.

**Y82.2** In addition, groups of conduits, cables in multi-compartment trunking and the sheaths of groups of cables shall be identified by a colour code marker as follows:-

**Y82.2.1** Lighting and Power = Orange

<b>Y82.2.2</b>	Fire Alarms	=	Signal Red
<b>Y82.2.3</b>	Telephones	=	White
<b>Y82.2.4</b>	Clocks	=	Brown
<b>Y82.2.5</b>	Security	=	Blue
<b>Y82.2.6</b>	Call Systems	=	Grey
<b>Y82.2.7</b>	Radio and TV Systems	=	Yellow
<b>Y82.2.8</b>	Lifts	=	Orange
<b>Y82.2.9</b>	Power to Mech Services	=	Orange

**Y82.3** The colour markers may be neatly painted bands or be self-coloured PVC or similar tags placed at intervals not exceeding 10 metres. For vertical risers two colour bands will be placed at each level (top and bottom).

All mains and sub-mains multi-core cables to be labelled at all terminations to describe their function.

Similarly, all spur units, isolators or items of control equipment will be suitably labelled.

**Y89** **Sundry Common Electrical Items**

**Y89.1** **Ingress Protection**

All enclosed electrical apparatus will be protected against the ingress of dust and moisture. This will apply particularly to switchboards, control panels, switches, accessories and appliances. Where necessary the protection shall extend to flame and explosion proofing.

All apparatus shall be certified as to the degree of protection in accordance with BS EN 60529 and any other applicable standard.

In general, and unless otherwise specified the minimum degrees of protection shall be as follows, according to location:-

<b>Y89.1.1</b>	Inside buildings which are dry and dust free.	IP32
<b>Y89.1.2</b>	Inside buildings which are dry but where dust may be present.	IP34
<b>Y89.1.3</b>	Outside buildings protected from direct rainfall.	IP44
<b>Y89.1.4</b>	Outside buildings totally exposed.	IP67
<b>Y89.1.5</b>	Wet locations where hoses may be used.	IP67
<b>Y89.1.6</b>	Plant rooms, switch rooms and/or where steam and condensation may be present such as kitchens.	IP44
<b>Y89.1.7</b>	In other situations, not covered above, reference should be made to the Client unless otherwise described in this specification.	

**Y90** **Fixing to Building Fabric**

**Y90.1** **Nails into timber**

When nailing fixings to softwood the nails must be at least three times the length of the clip/fitting being nailed. This may be reduced to twice the length if nailing into hardwood. Nailing should only be used for lightweight cable clips and for fixing trimmers etc. to structural timbers.

#### **Y90.2**      Nails into Masonry

Masonry nails must only be used for mounting timbers and backboards and for clips designed for such nails for use in fixing conduits etc which will be subsequently buried or concealed. These nails may be of the shot fired type provided clearance has been obtained from the Structural Engineer by the Services Contractor. Under no circumstances will masonry nail methods be permitted into breeze blocks and other low density or lightweight materials.

#### **Y90.3**      Screw fixings to timber

When screwing components to timber the length of the screw should be such that the whole of the tread of the screw is embedded in the timber being fixed to. Single fixings should be at least 25 mm long and where screws shorter than this are employed they should consist of multiple fixings. Screws can be steel slot or steel 'Pozidrive' but must be round headed where cables may come into contact eg; in steel accessory boxes, trunking etc. When fixing bare m.i.c.c. cables or bare copper earthing tape brass screws are to be used otherwise all screws shall be steel. Where there is a possibility of damp and corrosive situations the screws are to be galvanised. Screws used to fix external equipment must always be galvanised or sheradised. Screws used to fix aluminium components must be electroplated or chrome. Fixing in locations which may be subject to vandalism must have 'Pozidrive' heads or special locking devices, and where agreed with the Structural Engineers the slots will be fitted with hard setting resin compound.

#### **Y90.4**      Screw fixings to masonry

When screwing components to high density masonry eg; concrete brick etc. the length of the screw should be such that the whole of the thread of the screw is embedded in a propriety fibre plug or polypropylene plug buried firmly in the material being fixed to. Nylon plugs with contoured bodies should be used when fixing into aerated concrete, breeze and other lightweight building blocks. Single fixings should be at least 25mm long and where screws shorter than this are employed they should consist of multiple fixings.

Screws can be steel slot or steel 'Posidrive' but must be round headed where cables may come into contact eg; in steel accessory boxes, trunking etc. When fixing base m.i.c.c. cables and bare copper earthing tape brass screws are to be used otherwise all screws shall be steel. Where there is a possibility of damp and corrosive situations the screws are to be galvanised or sheradised. Screws used to fix external equipment must always be galvanised or sherardized. Screws used to fix aluminium components must be electroplated or chrome.

Fixings in locations which may be subject to vandalism must have 'Posidrive' heads or special locking devices and where agreed with the Structural Engineers the slots will be filled with hard setting resin compound. All fixings onto plastered walls will be made in such a way as to avoid any part of the fixing taking place within the plaster.

**Y90.5**      Heavy duty fixings into masonry

All heavy fixings into masonry will be made expanding bolt type fixings into high density materials. These fixings, for maximum effect, will be placed into tight fitting holes drilled into dense material eg; concrete slabs or walls or the centre of hard bricks. Expanding bolts should not be drilled into mortar courses or into light materials. When fixing into concrete avoid any such fixings close to edges and corners where the action of expansion could cause splitting. As an alternative cast in screw sockets can be secured to shuttering and/or steel work to provide cast in fixings where these are more appropriate.

**Y90.6**      Hollow fixings

When fixing into hollow fix partitions ceilings or walls, only proprietary devices designed exclusively for this purpose shall be used. Acceptable devices are:-

- Y90.6.1**    Gravity toggles.
- Y90.6.2**    Spring toggles (to spread load)
- Y90.6.3**    Collapsible sleeves (light loads)
- Y90.6.4**    Interset (removable fixing)

**Y90.7**      Other fixings into masonry

Other fixings such as 'Philblocks' and chemical fixing compounds are acceptable methods provided the manufacturer's directions are followed and the Structural Engineer agrees to the methods to be employed.

**Y90.8**      Fixing to steel structure

Fixing to structural steelwork will be made by one of the following methods:-

- Y90.8.1**    Snap on spring clips for general light loads such as cable and conduit fixings.
- Y90.8.2**    Rivet fixings up to 3mm thickness for light loads. Generally such methods will secure a bracket which will then be used to fix a conduit or small cable.
- Y90.8.3**    Cartridge powered fixings to BS 4078 and colour coded to BS 381C may be used in steel but the material to be fixed to must be checked by hand before attempting a fix and agreement must be obtained from the Structural Engineer.  
In view of the uncertainty of cartridge powered fixings the Services Contractor must assume, when tendering, that he/she will have to drill and bolt all heavy duty fixings.
- Y90.8.4**    Fixings using steel nuts, bolts, plain and serrated washers can be employed when fixing to steel. Before drilling the Structural Engineer must be notified.
- Y90.8.5**    Proprietary fixing methods appropriate to the circumstance will be permitted provided they are of proven reliability and properly selected in consultation with the manufacturers, and, installed strictly in accordance with their advice/recommendations.

**Y91**            **Off-Site Painting/Anti-Corrosion Treatments**

**Y91.1**           Steel components mounted externally or in internal areas subject to dampness or corrosion

In these areas steel brackets, fixings etc. will be hot dip galvanised. Any damage to this finish must be treated with a heavy leaded paint to cover any exposed part. If unreasonable damage has been sustained during installation or subsequently the finish fails, during the maintenance period, the Services Contractor will be required to replace such components.

**Y91.2**           Steel components mounted internally but out of sight, eg; within suspended ceilings, ducts etc. which are not normally accessible etc.

In these areas steel brackets, fixings etc. will be painted with two coats of 'Galvafroid' or similar rust proofing paint before installation. Any damage to this finish after installation must be treated with similar paint to cover any exposed parts. If unreasonable damage has been sustained during installation or subsequently the finish fails, during the maintenance period, the Services Contractor will be required to repaint such components which may involve dismantling.

**Y91.3**           Steel components mounted internally and visible, eg; in plant rooms, switch rooms, and in any other exposed position which are normally accessible.

In these areas steel brackets, fixings, sheet steel panels switchgear etc. will be treated before delivery in the following manner:-

**Y91.3.1**        All components will be performed and all machining completed.

**Y91.3.2**        All components will be degreased and electroplated.

**Y91.3.3**        All components will be assembled and spray painted with a primer.

**Y91.3.4**        Finished with stoved epoxy powder. The colour of the final finish will be agreed as required.

**Y92**            **Motor Drives – Electric**

All components containing motors will normally be suitable for a 230 v single phase 50 Hz supply or 400v three phase 50Hz supply and will comply with BS 4999 and BS 5000.

**SECTION Z: BUILDING FABRIC REFERENCE SPECIFICATION**

**Z11**            **Purpose Made Metalwork**

The Electrical Contractor will be responsible for producing any additional metalwork purpose made to suit the requirements of the installation where it is not possible to utilise standard manufactured metalwork.

**Z20**            **Fixings/Adhesives**

These will be of approved types and manufacture and must avoid VOC's details of which are given in the additional requirements detailed in Part 1 clause 1.24 and subsequent additional requirement clause (A) which follows Section Z22.7.

## **Z22**      **Fire Resistant Seals**

- Z22.1**      The material to be used will be as designed to meet this Specification or any other Authorities requirements to comply with Building or similar Regulations.
- Z22.2**      Wherever any cable or group of exposed cables, trunking, tray or conduit passes through 'fire separating' wall, floor, ceiling or other fire resistant part of the structure, (refer to Architects detailed drawings), the Electrical Contractor will be responsible for fire sealing around these services and the surrounding structural opening. Approved fire resistant seals or compounds only will be used from specialist approved manufactures such as **Promat UK Ltd (Cape Durasteel Ltd)**. **This also applies to incoming and outgoing cables through external walls of the building.**
- Z22.3**      The Sub-Contractor will construct these fire resistant seals using the specified sealant. This material will be installed in strict accordance with the manufacturers recommendations.
- Z22.4**      In this context fire separation is deemed to be any structural floor, or wall surrounding the stairs core, fire escape corridors, sub-station, plant room, or, any barrier wall constructed within the roof. Always floors are deemed to require fire resistant seals for any services that penetrate.
- Z22.5**      Cable trunking will contain internal fire barriers as previously detailed in Clause Y60.
- Z22.6**      The Sub-Contractor should allow for all costs involved with the installation of these seals.  
**No alternative will be accepted without prior approval.**
- Z22.7**      The Sub-Contractor is to check with all of the latest Architects plans to ensure that the appropriate fire integrity is maintained and not compromised.

## ADDITIONAL REQUIREMENTS:

### (A) Volatile Organic Compounds

**Wherever practical Volatile Organic Compounds (VOC's) must be avoided.**

Manufacturers are beginning to appreciate how serious this can be and add details on their products but decoration materials, carpets, flooring sealants and adhesives are likely to be the main products encountered where particular care is to be taken.

Of particular concern to children's health and wellbeing are the following VOC's:-

Acetaldehyde	Acrolien	Benzene	Formaldehyde
Phenol	Pentachlorophenol	Toluene	Xylene
4-Phenylhexane Styrene	Decane	Butoxyelthanol	Isopentane
Limonene	Percholoethylene	Methylene Chloride	Vinyl Chloride

All Contractors will be required to demonstrate at the commencement of the contract that they have taken all possible steps to comply with this new requirement.

### (B) Building Regulations Part L2(h): Log Book

In addition to O&M Manual and Record Drawings (see Part II A37), you are required to produce separate log book as specified – In the circumstances, you should at least add a dedicated section to comply with 'The Requirements' of Building Regulations Part L2(h) on page 8: "providing sufficient information with the relevant services so that the building can be operated and maintained in such a manner as to use no more energy than is reasonable in the circumstances".

Include concise sub-sections/titles for; PC (Practical Completion/handover, reviews/responsibilities of the manager, links to other/main documents etc, commissioning compliance, outline design with key do's and don'ts, summary of areas/occupancy and activities, overview of controls/settings, occupant information/efficient cost saving measures, monitoring controls/setpoints and sub-meters including on main electrical distribution panel, performance record/table for end use comparison, maintenance review etc. and log sheet for results of in use investigations/record of defects liability work and evaluations.

Draft copy of log book must be issued to the Consultants for comment prior to formal issue of final document at PC/handover compete with electronic copy of the same on CD, and for the Consultants records.