



Standard Electrical Clauses



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## **1.0 STANDARD CONDITIONS**

### **1.1 Extent of Specification**

The Specification refers to the supply, installation, testing and commissioning and maintenance during the warranty period for the complete engineering building services to be carried out by the Contractor.

In the event of a discrepancy and/or contradiction between the Specification and related documents and drawings, the Contract Administrator (CA) will supply such particulars or verify and rectify the discrepancy.

Should the Contractor discover any such discrepancy they shall bring it to the attention of the CA.

Where "Standards of Materials, Workmanship and Installation" is at variance with "Particular Requirements", the Particular Requirements shall take precedence. The contract works shall comprise the complete installation and shall include manufacture, works testing and delivery to site, setting to work, testing and commissioning, provision of records and operating and maintenance manuals for the new and modified engineering building services as specified herein and outlined on the tender drawings.

The contract works shall comprise the whole of the labour and all materials necessary to form a complete installation and such tests, adjustments and commissioning as are described in subsequent clauses and as may otherwise be required to give an effective working installation to the satisfaction of the CA.

Contractors carrying out any mechanical and electrical installation work shall belong to the following applicable bodies:

- NICEIC
- ECA
- HVCA

### **1.2 Visit to Site**

The Contractor shall visit the site before completing their tenders, and will be deemed to have satisfied themselves on the full nature of local conditions as regard accessibility, transport and storage of materials, the supply of and conditions affecting labour, and to have obtained all necessary information on all matters affecting the execution of the works. Access to the site shall be strictly by appointment only, arranged through the CA.

When the works are associated with existing and occupied buildings the Contractor shall make prior arrangements with the person in charge of the establishment before visiting the site. The address of the establishment and telephone number will be found in the supplementary specification.

Claims on the basis of want of knowledge in respect of site condition will not be accepted.

### **1.3 Definitions**

The definitions for words, and phrases associated with the design, manufacture and site works for the mechanical installations shall be those of the IEE Regulations, CIBSE (Chartered Institution for Building Services Engineers) and BSRIA (Building Services Research and Information Association) Guides, British Standards, Codes of Practice, associated Statutory Acts and mandatory authorities.

Other non-technical definitions follow:

- a) Contract Administrator (CA):       The Architect or their appointed representative.  
  The Project Manager or their appointed representative.  
  The Building Services Consultant or their appointed representative.
- b) Engineer:                                 The designer for the mechanical and/or electrical services.



- c) Contractor: Electrical Contractor, unless defined otherwise.
- d) Contract Preliminaries: This refers to the main contract preliminaries. The Contractor shall be responsible for ensuring that his tendered sum is all inclusive.
- e) The Site/ Project: Refer to the Particular Specification for details.

#### 1.4 Regulations & Compliance

All materials and workmanship shall be the best quality in accordance with the standards specified and shall conform to the requirements of the regulatory bodies as given in the specification and contract documents.

All materials specified shall be in accordance with the latest British/European Standard Codes of Practice, British/European Standard, and ISO standards (latest amendments), Engineering specification. The whole of the works shall be executed in the most workman like manner. It shall comply with the best practices of the trades and conform in all respects with the current requirements.

The Contractor shall provide certificates or letters stating the materials and installations are in accordance with the authority having jurisdiction over them, the regulations applicable, and the applicable British and ISO standards as follows:

- Asbestos Regulations
- British Standards
- BS 7671 (IET Wiring Regulations latest amendments)
- BSRIA: Building Services Legislation – a directory of UK & EU Regulations
- Building Regulations
- CDM Regulations
- CIBSE Guides and Technical Memorandum
- Clean Air Act
- Construction Health & Safety and Welfare Regulations
- DfE Building Bulletins
- The Equality Act 2010
- Electricity at Work regulations
- Environmental Protection Regulations
- Factories Acts
- Fire Officer Committee Regulations
- Gas safety & installation regulations
- Health and Safety at Work Act
- Health and Safety Executive Guidance and Approved Codes of Practice
- Home Office Regulations
- HVCA Standard Specification
- IGEM Publications
- Local Authority By-laws
- Provision and use of work equipment regulations
- Public Health Acts
- Chartered Institution of Building Services Engineers
- Statutory Instruments and any other relevant Acts of Parliament.
- Water Regulations

Should there be any item specified or shown which may be considered as not complying, the Contractor shall notify the CA of this so that dispensation and/or clarification can be obtained.

If certificates are not issued by the Authority having jurisdiction then the Contractor shall submit a letter stating the work complies in all aspects to the above standards and regulations.



Any apparent conflicts found between the drawings, the specification and statutory requirements are to be notified immediately in writing to the CA by the Contractor.

### **1.5 Contractor Design Portion of the Works**

Where sections of the works have been specified on performance parameters and the Contractor has selected systems and equipment to meet these performance criteria, the Contractor shall ensure such systems and/or equipment will fully meet the specified performance requirements.

Additionally, the selected systems/equipment shall not be incorporated in such a way as to adversely affect the operation of the rest of the installation.

The Contractor shall provide to the Engineer, drawings, calculations etc., to prove his selections for performance specified works. These shall be provided before work commences on site in a reasonable time (minimum 14 days) for comments to be issued.

The Contractor shall not commence ordering materials & equipment or proceed with an alteration until the drawings etc. have been commented upon by the Engineer. These comments will not be unreasonably withheld.

### **1.6 Schedule of Rates and Quantities**

The Contractor shall on request submit within 14 days a Schedule of Quantities and rates upon which the tender has been based.

The Schedule should detail quantities or rates for all work in accordance with the Standard Method of Measurement current edition. The Schedule shall be fully priced and totalled to the tender price. The schedule will be used for the pricing of variations.

In the event of discrepancy in the Schedule, the quantities and or rates they shall be corrected as necessary, the total sum shall not be amended.

### **1.7 Instructions and Variations**

No variation shall be undertaken without written authorisation.

The cost of each variation when requested shall be submitted before the work is carried out. Where permission is granted to proceed with the variation the cost shall be submitted within 14 days. Where work is carried out as dayworks the cost shall be submitted immediately the variation work is completed.

When materials and equipment not included in the Schedule of Rates are required under a variation, the estimate submitted shall include a copy of any quotation received from the supplier and shall show separately the allowance required for overheads and profit.

The price for a variation or instruction shall include any loss of time, out of sequence working or any effect on the Contractor's programme.

Subsequent claims for anything associated with a variation or instruction will not be accepted.

### **1.8 Daywork**

No work shall be carried out at daywork rates without prior written approval.

Where daywork is permitted, time sheets signed by the Clerk of Works or other authorized personnel shall be submitted with detailed material schedules to support any claim. Where daywork exceeds one month in duration, time sheets shall be submitted at periods not exceeding one month.

The signing of daywork sheets by the Clerk of Works or other person will not constitute authorisation of the work.



The cost of authorised daywork will be calculated in accordance with the current Definition of Prime Cost of Daywork carried out under the Building Contract issued by the Royal Institution of Chartered Surveyors and the National Federation of Building Trades Employers. The percentage additions are for overhead, profit and those items defined in Section 4 of the above document.

Labour rates will be those current at the time when the daywork is carried out and will be strictly net HVCA for mechanical contracting rates and JIB for electrical contracting rates and in accordance with the Working Rule Agreement.

## 1.9 Approval

The specification shall not be varied in any way unless agreed in writing. Where the specification indicates that approval is required for materials, workmanship, products or installation methods, time must be allowed by the Contractor within the construction/installation programme for this approval to be given in writing (14 days).

Adequate time must be allowed for the CA to comment on the proposed alternatives, generally 10 working days unless stated otherwise in the terms of the agreed contract.

## 1.10 Quality of Materials, Workmanship & Standards

The contract works shall be executed in a neat, substantial and workman like manner and in accordance with BS EN ISO 9000: Quality management and quality assurance standards.

All materials and workmanship shall be of the various kinds described within the specification and shall be subjected from time to time to such tests as the CA may direct at the place of manufacture or fabrication, or on site or at such other place or places as may be specified herein.

The Contractor shall ensure that all materials and equipment supplied are in accordance with all current issues and amendments of relevant British Standards, Specification and Codes of Practice. The Contractor shall ensure that all electrically powered equipment and materials supplied are suitable for the LV electricity supply available.

Where and to the extent that materials products and workmanship are not fully specified, they are to be suitable for the purposes of the specified works stated herein and the contract documents and in accordance with good building practice, including the relevant provisions of current British Standards and other associated documents.

The execution of the works shall be subject in all respects to the comment of the CA. No approval, comment or acceptance by the CA shall relieve the Contractor of his design responsibilities under the terms and conditions of the contract for the quality of materials and the standard of workmanship provided.

The design, manufacture and installation of all plant, equipment and materials shall comply with all local codes and regulations.

Where any portion of the Contract Works is covered by a British Standard Code of Practice the requirements of that Code are to be complied with unless specifically instructed by the CA in writing in reply to the Contractor's request for a ruling.

The Contractor's attention is drawn to the fact that when enquiring for manufactured materials the manufacturer should be advised of the relevant standards. The consequences of any failure to comply with this requirement shall be the Contractor's sole responsibility.

The Contractor shall be responsible for passing full details to the manufacturers of all materials and shall not assume that the CA has already established the necessary basis for quotations.

Materials used in conjunction with or as part of the installation shall be incapable of spontaneous combustion, nor support combustion once ignited and shall be self-extinguishing.



All runs of pipework, cable trays and electrical containment, ductwork, plant and equipment and all accessories shall be truly aligned with each other and the building, plumb or level.

The Contractor shall allow, at no additional cost, for disconnecting and replacing after inspection any item of plant, pipework, ductwork, fittings or accessories which are not installed in accordance with the requirements of the specified standards of materials and workmanship and re-fix the whole or any part of the installation as required by the CA.

Except where specified otherwise, all materials and equipment associated with the installation shall be handled and installed strictly in accordance with the manufacturer's recommendations and shall be handled and installed by workmen who have had previous experience of the equipment and materials and who have, where necessary, attended a manufacturer's course on use and installation.

The Contractor shall ensure that any special tools recommended by manufacturers for the installation of their materials and equipment are used by the workforce.

The Contractor shall demonstrate that his workforce is competent and experienced to carry out the installation work to the standard called for in this specification.

Where applicable the Contractor shall obtain and submit to the CA all manufacturers' guarantees of performance.

### **1.11 Manufacturer's Standards**

The inclusion in the drawings and specification of the names of any companies or proprietary items shall read as an indication of the quality, performance and workmanship required.

Where manufacturers or companies are specified as Suppliers or Sub-Contractors they shall work within the terms and conditions of the Contract. The tender shall be submitted including materials and equipment by the manufacturers specified.

All materials and equipment shall be suitable in all respects for the site conditions, both in terms of climate and specific location. Conditions under which these items are to be installed must also be taken into consideration. All equipment shall be capable of operating continuously under variation in the supply system of  $\pm 10\%$  in the voltage and  $\pm 1\%$  in the frequency.

The Contractor may submit alternatives for consideration and these shall be submitted during the design period quoting the alternative manufacturer, catalogue reference or range without increase of costs to the tender price.

The CA reserves the right to agree to alternative manufactured materials only if they meet or exceed the requirements of the originally specified product. The cost of any redesign would be at the Contractor's expense.

Acceptance of alternative manufactured materials and equipment shall not relieve the Contractor of his contractual responsibilities.

### **1.12 Samples**

Where products or materials are subject of the CA's comments, samples shall be submitted or other evidence of suitability shall be provided. Orders shall not be confirmed or materials used until the CA's comments have been received and approval granted. Approved samples shall be retained on site for comparison with products and materials installed.

### **1.13 Conditions of Service**

The contract works shall be installed to facilitate inspection, cleaning repairs, and for operation in which safety and continuity of services are the first considerations.

All plant and equipment shall be designed to ensure satisfactory operation under the atmospheric conditions prevailing at the site.





The completed installations shall incorporate every reasonable precaution and provision for the safety of all those concerned in the installation, operation and maintenance of the Contract Works.

All materials used shall be of the best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions arising under working conditions without distortion or deterioration or the setting up of undue stresses in any part, and also without affecting the strength and suitability of the various parts for the work which they have to perform. No welding, filling or plugging of defective parts will be permitted without the approval in writing of the CA.

The selection of all plant and equipment must be such that variation may be made to its specified duty on site without major replacements. All plant and equipment shall operate without undue vibration and not exceed the specified noise levels.

In the selection of plant and equipment spare parts must be assured and preference should be given to manufacturers that have local offices and/or agencies that offer a full spares and maintenance service.

Operating boxes, kiosks, cubicles and similar enclosed compartments forming part of auxiliary equipment shall be adequately ventilated to restrict condensation and, where environmental conditions require, suitable integral low-temperature heaters shall be provided. All contactor or relay coils and other electrical parts shall be suitably protected against corrosion.

All externally mounted apparatus shall be so designed as to avoid pockets in which water can collect and shall be weatherproof.

The underside of all tanks and cylinders shall be ventilated in an approved manner to prevent corrosion. Accessible means shall be provided for the easy lubrication of all bearing, mechanisms and moving parts. Grease lubricators shall be fitted with hexagon nipples. All mechanisms shall, when necessary, be constructed of stainless steel, brass or gunmetal to prevent sticking due to rust or corrosion.

All rubbing or wearing surfaces shall be machine faced. Joints employing a gasket material shall be so constructed that the packing is maintained under sufficient compression in all jointing compound. Gasket material shall be of the minimum thickness necessary and of approved composition.

All apparatus shall be designed to obviate the risk of accidental short circuit due to animals, birds and vermin. Openings in ventilated enclosures shall be so constructed to prevent the entry of vermin and insects.

All apparatus incorporating doors shall be erected so that the doors can be opened to at least 90° after adjacent equipment has been installed.

#### **1.14 Supervision**

The Contractor shall employ and maintain on the works a suitably trained and experienced supervisor, for the duration of the contract. The CA shall have the right to require replacement of any such person whose general conduct or quality of supervision is in the CA's opinion unsatisfactory.

#### **1.15 Site Cleanliness**

It is the responsibility of all operators to maintain site cleanliness. The Contractor shall provide and enforce all site cleaning procedures to the CA's requirements.

Prior to any air system being started all of the following must be signed off, as being complete by the CA:

- a) Temporary protection of air inlet if site conditions require.
- b) Cleanliness of pipework
- c) Cleanliness of ductwork.
- d) Cleanliness of electrical switchgear, lighting fittings and accessories
- e) Dust sealing of all structural and Architectural components within the air-stream (floor voids and ceiling voids included).



### **1.16 Access for Plant Installation and Subsequent Removal**

Before work is put in hand and orders are placed for large plant, the Contractor is to check on site or with the drawings if the plant has to be ordered before the building work is at a suitable point, the dimensions of all doorways, etc., serving as access to ensure that each item can be admitted to its allotted position and installed in such a way together with all other services, and that it can be replaced with similar replacement equipment at some future date.

The Contractor can be called upon by the CA to demonstrate that plant and equipment can be removed for replacement or maintenance purposes and replaced, using the same materials except gaskets. Should the Contractor find during installation that it is not possible to make any equipment removable, then the Contractor must modify the arrangement in conjunction with the CA and all others concerned. On no account can the CA accept equipment that cannot be readily maintained in position, unless specifically agreed in a particular case in writing when maintenance after removal would be accepted.

### **1.17 Painting and Galvanising**

The Contractor shall be responsible for protecting all equipment that has been installed from damage, and shall thoroughly clean all equipment before it is handed over. Any damaged paintwork shall be made good in colour and type of paint to match the original manufacturers finish.

Mild steel or iron brackets or other items to be built-in are to be painted before building-in. In the case of materials or plant which is delivered to site already primed, the Contractor shall ensure the primer is suitable for the type of paint to be subsequently applied and shall make good any damage to the primer before further coats are applied. All items to be painted shall have an undercoating and a finishing coat in addition to the primer appropriate to the material being painted. The finishing coat shall be to a colour to be approved by the Engineer.

All paints including primers, undercoats and finishing coats shall be of the best quality and shall be obtained from a Company approved by the Engineer, and shall be used in accordance with the makers instructions. Painting shall be done in accordance with the best practices in the trade. All surfaces must be thoroughly prepared including removal of dust, grease and protective coatings and in the case of iron or steel, the removal of rust and scale by abrasion followed by the application of an anti-rust solution to remove pitted rust.

Where a galvanized finish has been specified it shall be applied by the hot dip process to BS EN ISO 1461:2009: Specification for hot dip galvanised coatings on iron and steel articles. Except where otherwise approved, all iron and steel shall be galvanised after sawing, shearing, drilling, punching, polishing and machining are completed. The coating shall be smooth, clean, of uniform thickness and free from defects. Galvanising shall not adversely affect the mechanical properties of the coated material. Any surfaces which have deteriorated or become damaged prior to handover, shall be made good by cleaning and applying a cold galvanising paint.

### **1.18 Storage**

Unless otherwise stated in the Main Contractors preliminaries, no storage facilities will be provided by the Client for the use of the Contractor. Should the Contractor come to some suitable arrangements with the person(s) in charge of the establishment, for this purpose, the Client will not be responsible for any loss or damage that may be sustained by the Contractor.

### **1.19 Redundant Materials (refurb/strip outs only)**

The Contractor shall allow for the disconnection, removal and carting from site of all materials and equipment made redundant by the new installation.

The redundant installation shall be confined to only the existing installation made redundant by the works specified herein and shown on the contract drawings. Other parts of the existing installation shall remain intact and undisturbed. If disturbance cannot be avoided, the installation shall be replaced in a workmanlike manner. The existing installation of lighting etc. shall remain intact until replaced by the new, when it shall be dismantled by the Contractor. Where it is necessary to remove or divert any part of the installation in order to facilitate the carrying out of the new installation, the method of effecting the alterations and the materials to be used must be approved by the Engineer.



The Contractor shall strip out and dispose of all redundant wiring, fittings and materials from the existing installations where applicable to the contract, and shall allow in their tender any monies received in payment for scrap and/or redundant equipment.

The Contractor shall ensure materials are removed from site regularly to avoid inconvenience and danger to occupants. Disposal of hazardous waste shall be carried out in strict accordance with "The Hazardous Waste (England and Wales) Regulations 2005". All waste is to be segregated and disposed of in the most appropriate manner e.g. recycled, reused or as a last resort sent to landfill. Other parts of the existing installation shall remain intact and undisturbed.

## 1.20 Drawings

All drawings provided by the Contractor shall be produced in electronic format using AutoCAD software programme. The latest issue of the programme shall be used unless otherwise agreed before the contract is let.

Drawings submitted for comment shall be in paper format and not larger than A1 size unless previously agreed. Electronic copies of the drawings shall be submitted in both PDF and AutoCAD formats.

### Approvals (Where Applicable)

It shall be the Contractor's responsibility to ensure that drawings are submitted to the CA for comment in sufficient time to avoid delay in the works.

The Contractor shall be responsible for any omission, errors or any discrepancies in the drawings and other particulars supplied by the Contractor or the Contractors suppliers, whether such drawings or particulars have been commented upon by the CA/ Engineer or not, provided that such omission, errors or discrepancies are not due to inaccurate information of particulars furnished in writing to the Contractor by the CA.

Comments on any drawing by the CA/Engineer shall not mean that the CA/Engineer is responsible for the correctness of the drawing or its suitability for purpose. These responsibilities shall remain with the Contractor.

### Contract drawings (Where Applicable)

The whole of the work shall be executed according to the true intent and meaning of the contract, specification and drawings, and to the entire satisfaction of the CA. If during the tender period a discrepancy is noted, the Contractor shall inform the CA for the purposes of clarification.

The final position of equipment shall be taken from the installation drawings which have been commented upon by the CA. Diversion of conduits and cables to avoid clerestory windows, roof lights, doorways and other services and slight variations will not be considered for extra payment.

All specifications, drawings and documents remain the property of the Engineer.

The position of equipment, accessories and other points may require adjustment to suit the layout and these shall be agreed with the CA.

The Architectural drawings shall also be used to obtain details of tiling, finishes and furniture layout, etc., when planning the position of all other items of the electrical/mechanical installation. The hanging of all doors shall be confirmed before commencing any installation work.

### Manufacturers drawings (Where Applicable)

Shop fabrication drawings shall be developed from, and fully co-ordinated with, the current contract drawings for the Mechanical and Electrical installations, Architectural and Structural Engineering construction drawings.

Drawings shall be fully detailed and dimensioned indicating centers of supports and manufacturing details of the brackets which shall be submitted to the CA for comment. The Contractor shall allow sufficient time within his programme for site dimensions to be taken and not totally reliant upon the contract drawings.



Dimensions given on the drawings are nominal sizes. All dimensions of ductwork shall be internal clear air way as shown on the drawings. Where ductwork is specified as being acoustically lined internally, these shall also be the clear inside dimensions.

Any errors in the manufacture of the ductwork requiring alteration shall be corrected at the Contractor's expense without delay to the agreed construction programme.

Manufacturer's plant and equipment fabrication drawings shall be submitted to the CA for comment 14 days before manufacture commences. It shall be the CA's responsibility to ensure that comments are returned without causing delays therein. All drawings shall be produced using the version of AutoCAD/RevIT as instructed by the CA.

#### Installation drawings (large projects only)

Work shall not commence until installation drawings have been commented upon by the CA. Delays due to late or inadequate submission of drawings or information will not be accepted. Works undertaken without CA's comments having been made will be at the Contractor's own risk.

The following drawings shall be submitted to the CA for comment. This list is not exhaustive and additional drawings may be called for within the design and construction period:

- Mechanical Plant & Electrical Switch room layouts.
- Co-ordinated pipework layout
- Boiler flue installation drawings
- Co-ordinated mechanical & electrical drawings
- Electrical installation including power and control wiring
- Electrical Distribution switchboard/panels
- Builders work in connection
- Under floor heating
- Co-ordinated external services

#### Revisions and variations (Where Applicable)

Where schemes are subject to revision or variation, then the installation/working drawings, and finally the record drawings, must show the full effect. Where the scheme revision involves change to the Architectural or Structural details immediate notice must be given to the CA.

Where scheme revisions are required to the works due to the Contractor's variation or revision then all cost for such revision will be the Contractor's responsibility including the design team consultants' costs incurred in the incorporation or administration of such revision.

Designer's drawings must not to be used on site, all actual and proposed installation must be recorded accurately on a site set of drawings updated and available for inspection on site.

Where drawings are revised and updated during construction these shall be issued to the CA for comments on the revision only.

Only if the Contractor can give proof that a significant departure from the intent of the Specification has been necessary will a variation be recorded. This will not include normal detail development relating to inclusion of, nor development of, factors within the Contractor's design responsibility.

The Contractor shall maintain, on site, a detailed marked-up record of the progress of the works detailing the extent of completed installation and all departures from the installation/working drawings. This site record must be incorporated in to the draft record drawings at no more than monthly intervals.

#### Builders work drawings (Where Applicable)

The Contractor's attention is drawn to the fact that some builder's work provision may have already been made within the design development interfacing with the Architectural and Structural Engineering schemes.



The Contactor shall be responsible to detail their installation/working drawings around the Builder's Work information provided by the CA. If the Contactor considers it necessary to amend any Builder's Work information, the Contractor shall bring this to the attention of the CA who will amend drawings if appropriate.

The Contactor shall prepare all other necessary Builder's Work Drawings required for the execution of this Contract, making due reference to the Structural and Architectural final dimensioned detail drawings as applicable. All drawings must be fully dimensioned.

The Contactor shall be required to mark on site actual locations of all builder's work holes through walls, partitions, floors, etc., and also chases in walls, floors, etc., for conduits, pipes and the like and offer them for inspection by the CA prior to carrying out any work.

The Contactor shall establish a method of working with the CA to ensure the works may proceed without hindrance.

All Builder's Work drawings provided by the Contactor must be provided in sufficient time to comply with the agreed programme requirements and all costs arising from failure to do so will be met by the Contactor.

The Contractor shall submit detailed builders work requirements to enable holes through the structure, over and above 50mm dia. to be constructed ahead of the installation and be incorporated into the building construction without causing delay to the building programme.

The drawings submitted to the CA shall include full details of all plant bases. Plant bases shall be of a minimum 150mm clear height using materials commensurate with the floor on which the plant is to be located.

Openings in the roofs shall include an upstand kerb or collar. The Contractor shall provide an over flashing apron over the upstand. The collar shall be fixed and sealed to the side of the ductwork.

Drawing co-ordination (Where Applicable)

The Contractor shall be responsible for ensuring that the drawings are fully co-ordinated with all other disciplines for the purpose of construction comprising Architectural, Structural, Ductwork, Sprinkler, Mechanical & Electrical services drawings.

Any clashes shall be corrected at the Contractor's expense and without affecting the construction programme. Comments made by the CA or the nominated representative shall not relieve the Contractor of his responsibilities in this respect.

## **1.21 Contractor's Submittals**

The Contractor shall submit full details of the equipment to be used for the complete installation. It is the Contractor's responsibility to provide the required information prior to orders being placed. Any changes to the equipment proposed and that installed without written agreement from the CA, shall be changed accordingly at the Contractor's expense. Submittals shall be in addition and not in place of samples.

Submittals shall contain, as a minimum, the following applicable to the specified scope of works. Although the CA or the nominated representative will inspect all submissions, the Contractor shall not be absolved of their contractual responsibilities in respect of the installation and the scope of works. Any comments made by the CA do not constitute approval.

Equipment technical submissions

i) Fully detailed technical submission of all selected materials, items of plant and equipment:

- Manufacturer
- Type/Model
- Physical Size
- Output/capacity/duty
- Speed
- Electrical Load
- Sound levels



- Thermal insulation
- Electrical containment

ii) Schedules are to be submitted for the following equipment:

- Boilers
- Heat pumps
- Air handling plant including supply and extract fans
- Heat recovery ventilators
- Heat emitters
- Dampers (fire, volume control etc.)
- Silencers, A/V mounts, inertia bases
- Valves (isolating, regulating, control etc.)
- Grilles and Diffusers
- Under floor heating system
- Natural Ventilation system components
- Automatic controls and BMS
- Lighting fittings
- Automatic lighting controls (presence/absence detection)
- Switchgear and accessories
- Hand dryers
- All specialist equipment

Other submissions required

- Fully priced schedule of rates
- Certificate of compliance with contract information including specification and drawings
- Operating & Maintenance Instruction Manuals (2 copies)
- Building Log Book

## 1.22 Builders Work

### 1.22.1 Sub-contracts

The Contractor shall provide for attending on the site from time to time as and when they are required to set out the works and to instruct the Main Contractor as to the position of holes, bases, supports, etc.

Unless otherwise specified the Main Contractor shall carry out all work for engineering foundations, structural steelwork, cutting away and making good in walls, floors and ceilings, the cutting out and grouting in of clips, brackets, holding-down bolts, cutting of chases, etc., removal and replacement of other parts of the building fabric as may be necessary.

The Contractor will provide 150mm general/earthenware/plastic ducts within the foundations and/or floor slab of the building to facilitate the installation of the cables entering or leaving the building. These ducts shall be at the required depth and far enough from the building perimeter wall to finish in soft earth away from the areas of hardcore, ash, tarmacadam and paving.

Within the building the ducts shall terminate in the required position close to the relevant wall using easy bends (minimum bending radius of 1.2m), to facilitate the careful installation of conduit wiring accessory boxes and fixings generally.

The Contractor must allow for carrying out all their own associated builders work involved with such items as, drilling and plugging the structure for the fixing of any materials or fittings etc., or the supply of any clips, brackets or holding-down bolts, and must allow for the carrying out of this work and the supplying of the materials. This also applies to the supply, installation and painting of support steelwork for fusegear, switchgear, cables, cable tray and wiring enclosure, starters, control gear and lighting fittings etc.



The Contractor shall be responsible for drilling all their required holes up to and including 100mm diameter. The Main Contractor shall be responsible for all holes and openings greater than 100mm diameter.

The Contractor shall prepare drawings showing the positions and dimensions of all holes, ducts, chases etc., to be precast, built or cut in floors, roof, walls, ceilings or at any other position for the installation of the works, also drawings showing the size and construction of plinths, bases, special support of foundations required for this equipment.

These drawings shall be submitted to the Main Contractor with copies to the CA for comment. They shall be complete and show all the relevant dimensions, in particular the sizes, depths and locations of holes, bolt holes and ducts, etc.

The Contractor shall note that although the cost of incidental builders work is excluded from their contract, the cost of alterations due to inaccurate setting out must be borne by the Contractor. Before manufacturing any item of equipment required to register with holes to be cut by the Builder, the Contractor shall verify that it is in order for the holes to be cut in the position marked.

### **1.22.2 Direct Contracts**

This will be the responsibility of the Contractor.

All cutting away and making good shall be carried out by the Contractor. This shall include making good plastered surfaces and painting conduit and conduit accessories to match existing using competent specialist tradesmen.

Decoration of complete walls and/or rooms and/or wallpapering shall be carried out by others under a separate contract but the Contractor shall be responsible for leaving the works and making good, clean and prepared for following trades.

The Contractor's attention is drawn to the fact that buildings in any condition should be respected as such, and that care should be taken when cutting away. The cost of repairing any unnecessary or excessive cutting away will be charged to the Contractor.

When considered necessary, removal and replacement of fixed and permanent floor coverings, making good and minor reductions shall be carried out at the discretions of the Area Property Manager or persons, to be employed by the Contractor, but selected by the Area property Manager. The cost of these works shall be expended from a Provisional Sum.

When the contract works are being carried out in Listed Buildings, particular care should be taken and advice sought from the CA.

The Contractor shall use rotary masonry drills for fixings and boring holes through walls, floors etc., the use of percussion cutting tools will not be permitted in any part of the building.

When required, timber noggins shall be provided by the Contractor drilled and fixed in the required location to facilitate the installation of conduit wiring accessory boxes, and fixings generally. Fixing direct into false ceiling steel grid systems will only be allowed, using approved patent fixings.

The use of Disc Cutters in occupied buildings shall not be used unless written permission has been given by the Engineer in the interests of preserving the building fabric for a specific reason.

The Contractor shall dig, backfill and reinstate all cable trenches. When applicable, footpath, roadway or area lighting columns shall be placed perfectly vertical with the electricity cut out access door facing the required direction to facilitate easy maintenance and to avoid obstructions.

Dry concrete weak mix shall be poured around the base of the column to a depth of 150mm. A Polythene duct shall be provided from within the column cable chamber to a suitable distance in accordance with manufacturer's requirements from the column and within the ground to enable incoming and looping-in cables to be installed so that 'digging-out' close to the column, can be avoided.



Backfill and compact to within 200mm of ground level thence with 150mm dry concrete weak mix and finally with a 50mm concrete collar to dress the paving. If necessary finish to match other forms of dressing.

### 1.23 Setting Out and Co-Ordination of Services

The position of items of electrical equipment and plant indicated on the drawings are approximate and shall be used as a guide for tendering purposes. The exact position for fixing shall be determined on site to the approval of the Contract Administrator/ Engineer.

Where possible, items on vertical surfaces at varying heights shown adjacent to each other in the drawings shall be fixed vertically in line.

Symmetry of arrangement shall be obtained by horizontal and vertical alignment through the center lines and/or the edges of the equipment.

Items fixed within fair faced brick or blockwork, shall have their heights adjusted to center on horizontal course lines.

The Contractor shall be responsible for marking and setting out on site of all items, which shall be carried out in accordance with the requirements of the contract programme.

In order that the best use may be made of the space available for the disposition of services, it is essential that the Contractor shall co-ordinate their own work with the work of others carrying out installations on the site. The Contractor may be required to prepare such detailed drawing of the proposed position of plant and equipment as may be required to enable the work to be co-ordinated in the general construction of the building, and to attend any meetings which may be called for this purpose.

The Contractor shall be required to co-operate with any other specialist contractors who may be working on or be connected with the contract works. In positions where construction work and other services are to be installed, adjacent to or in the vicinity of these contract works, the Contractor shall co-operate in every respect with all parties concerned.

In positions where other installations and services are complete, the Contractor shall coordinate their installation accordingly so as to avoid disruption to these services.

In the event of other existing services requiring alteration to enable the services to be installed, the Contractor shall obtain written authorisation from the CA for alteration or amendment before such work is carried out.

### 1.24 Fixings & Supports

The Contractor shall supply and erect all steelwork brackets for equipment they are required to erect. Such brackets and supports shall be as manufacturer supplied or purpose made in accordance with the appropriate specification or drawings. All brackets and steelwork unless prefinished, shall be painted or treated before erection or any other equipment is fixed onto them.

All external steelwork fixings shall be galvanised. Fixing to brickwork shall be made direct into the brick or block and not the bond, unless the work is being carried out in an historical or listed building. Methods of fixing shall be appropriate to the weight and type of equipment being installed and shall comprise either screws and plugs, expanding bolts, nut and bolt or chemical fixings. Where there is any doubt as to the type of fixing that should be used, or the material into which the fixing is to be made, then specialist advice and the approval of the Engineer or Contract Administrator shall be sought.

It shall be the responsibility of the Contractor to ensure, that where necessary, all supports, brackets, steelwork, timber noggins etc., are built into the building fabric at the appropriate time during the construction process.

No steelwork or laminated timber beams/columns shall be drilled or cut for any purpose without the prior approval of the Engineer or Contract Administrator.





The supply and fixing of all supports, brackets, clamps and spacers and any other steelwork, whether or not shown in detail on the drawings required for the proper and effective fixing of any equipment, shall be considered to be included in the material and labour covered by the supply of that equipment.

Suitable special spanners shall be provided for bolts and nuts which are not properly accessible by an ordinary spanner.

#### **1.25 Clearances**

Access clearances to system components shall provide adequate space for the operation, servicing and removing without disruption to or dismantling of other equipment and accessories.

#### **1.26 Concealed Work**

Whenever work requiring inspection or testing is subsequently to be concealed, due notice shall be given to the CA so that inspection may be made or tests witnessed before concealment.

Failure to give due notice, of at least 48 hours, shall necessitate the Contractor uncovering the work and reinstating it at the Contractor's own expense.

The CA reserves the right to forego their inspection, this will in no way relieve the Contractor's responsibility to comply with the Employer's Requirements.

Where the CA believes that the installation may be defective the Contractor shall at his own cost uncover a specific area selected by the CA for inspection. This shall be restricted to 1 linear meter or 1m<sup>2</sup> depending on the nature of the work for each area of concealment. Reinstatement shall be at the Contractor's expense. Where works are proven defective by such uncovering, the entire installation shall be uncovered and brought into compliance with the specification.

#### **1.27 Off-Loading and Installation**

The supply, delivery, off-loading, positioning and installation of all equipment and materials detailed in the Specification or shown on the tender drawings shall form part of the contract works. This shall include the provision of all necessary craneage, hard standing for same, lifting tackle, trolleys, skids, tools, ladders, temporary workshop, gangways, fences, scaffolding other than that already erected, etc., and shall include the subsequent removal.

The strength of floors across which heavy loads are to be moved shall be checked well in advance of the load being applied so that any routes of inadequate strength can be additionally supported without delaying the progress of the works.

Plant and materials shall not be deposited on roadways, footpaths, corridors or rooms unless prior permission has been obtained in writing.

The Contractor shall be responsible for making good any damage caused in the off-loading, movement or storage of materials and plant.

Any materials or equipment damaged while carrying out these operations shall be replaced at the Contractor's expense.

Where it is necessary to store on site materials and equipment for later installation it shall be properly protected from damage and theft.

In general the material and equipment shall be immediately placed in a clean dry storage area which is enclosed and with the access lockable to prevent removal from site.

If the space is not for the sole use of the Contractor then adequate protection shall be provided to prevent damage resulting for the use of the space by others.



Unless the above provision is fulfilled, certification for payment of a valuation claim for the material and equipment will not be issued.

All materials and equipment which suffers damage while stored, or becomes dirty, dusty or water damaged shall be replaced at the Contractor's cost.

### **1.28 Protection of Works**

The Contractor shall ensure proper protection of the building, the site, installation and materials from damage due to their own work, building operator/users activities, other Contractor's operations, vandalism and weather.

Materials which suffer deterioration or rust will not be accepted and the cost of replacement or wire brushing, cleaning and repainting will be borne by the Contractor.

To ensure adequate protection of materials, no material shall be delivered to site until they are required in accordance with the installation programme.

This shall not be considered for delay on progress or completion of the contract.

Second fix materials, e.g.; accessories, radiators, light fittings, plant, and equipment face plates shall not be fixed in place until all decorations have been completed.

### **1.29 Provision of Dust Sheets & Access Equipment (Existing & Occupied buildings)**

The Contractor shall allow for moving and replacing loose furniture and erecting access equipment over fixed furniture as necessary for progressing the work.

Each room or area completed by the Contractor for re-occupation by the Client shall be cleaned, and all furniture replaced before occupation takes place.

The Contractor shall provide dust sheets and use them to cover furniture in every area where work is taking place. In addition to these areas, other areas in which builders work dust can drift and settle shall also be protected by dust sheets. Particular attention shall be taken to the protection and cleaning of kitchen areas.

### **1.30 Inconvenience to Occupants (Existing and Occupied Buildings)**

The Contractor shall ensure that, when work is being carried out in occupied buildings, any inconvenience caused by the presence of the Contractors workforce is kept to an absolute minimum and on no account should the occupants of such building be harassed or aggravated by operatives creating a disturbance due to shouting, whistling or singing. Under no circumstances shall portable radio or music players with loud speakers be used during working hours, inclusive of lunch and tea breaks.

The Contractor's work force shall conduct themselves in a courteous manner at all times. It will be deemed that the Contractor has made due allowance in his tender for the lack of continuity of works due to the aforesaid inconvenience taken to the protection and cleaning of kitchen areas.

### **1.31 Maintaining Existing Services (Existing and Occupied Buildings)**

The Contractor must ensure that all existing services are maintained in good working order at all times during the contract period and all supplies in occupied areas are fully maintained during the required period of occupation.

At no time are staff to be left without the services they require; all negotiations to be carried out via the person in charge of the establishment or persons they so delegate. Where necessary temporary supplies shall be installed, including the use of generator sets where required.



The contractor shall allow for temporary supplies within existing building for fire alarms, intruder alarms, emergency lighting, residents call systems, telephone systems, data systems, office IT, fridge freezers and any other services..

In all cases particular care must be taken to ensure that any existing fire alarm, emergency lighting, residents call systems, telephone systems, intruder alarm, staff alarm system, fridge freezers, Office IT any other equipment/area are maintained in good working order at all times during the contract period.

Where alterations to the services involves the disruption to the existing installation which is to remain, the Contractor shall test the installation prior to any works commencing and report any defects/deviations from the standards to the CA. Test and inspection reports shall not be relied upon for this information.

### **1.32 Safety Precautions**

The Contractor will not be allowed to use any naked lights, acetylene cutting or welding plant or to make any fires without a method statement and risk assessment agreed by the CA, and an appropriate permit to work issued.

The Contractor shall be responsible for the condition of all their own/hired plant and portable hand tools used by him for progressing of the works. All portable tools must be 110 volts and fed from a double wound transformer, with the secondary mid-point connected to earth.

Should it be necessary to install temporary supplies, this should be done in such a way that the safety of the staff and pupils/building occupants, visitors are given priority consideration, and is in no way hazardous or detrimental to them, or the existing building and building fabric.

For residential properties the Contractor must ensure that because of the particular circumstances whereby persons are in residence, the Contractor shall be required, when leaving the site at the end of each working day, to clear away tools, materials and plant, to replace floor boards and to ensure that no new, existing or temporary services shall interfere with or restrict the movements of the residents, or affect the safety of the residents.

The Contractor shall effectively cordon off areas where work is being undertaken. Where floor duct covers are removed, the opening shall be securely barricaded to a standard not less than acceptable for a public walkway. Should the remaining access available be less than 600mm wide then a "no through route" shall be declared. Suitable warning notices stating "Duct covers removed" or "Danger work in progress" for example, shall be displayed at all times. Escape routes must not be impeded, any alternative shall be agreed with the CA.

Access equipment, (i.e.; workstations, scaffolds, steps and ladders), shall be protected and made safe by a tradesmen in attendance at floor level.

All materials and equipment shall be stored and left in a safe position to prevent any hazards to building occupants, visitors or operatives.

The Contractor shall ensure that all their operatives, sub-contractors and tradesmen comply fully, at all times, with the Health and Safety at Work Act and CDM regulations.

### **1.33 Asbestos (Existing and Occupied Buildings)**

The Contractor shall be aware that there may be asbestos based products installed within the existing building(s) and the Contractor shall take suitable steps to ensure that all their staff and sub-contractors are aware that asbestos may be encountered.

Before undertaking any work or disturbing existing materials the Contractor shall check a copy of the Asbestos Register which records where asbestos is probably present. The Asbestos Register is not a definitive record of all asbestos on the site. The Contractor shall consider whether a more detailed survey is required before commencing work. Under no circumstances shall a Contractor disturb any material which may contain asbestos without specific instructions from the CA.



In the event of asbestos being found anywhere on the site works shall stop immediately and must be reported to the CA and the site's Health & Safety representative simultaneously. The CA will take the necessary action outside of this Contract. No works shall be undertaken in these areas until the CA has completed investigations or remedial works and a "Certificate of Clearance" has been given.

## **1.34 Handover**

### **1.34.1 Testing and Commissioning**

All testing and commissioning shall be carried out and the results shall be witnessed by the CA prior to practical completion being granted.

### **1.34.2 O & M Instruction Manuals and Record Drawings**

Approved manuals and record drawings shall form part of the handover and a certificate of practical completion will not be issued without the final approved documents being handed to the CA.

### **1.34.3 Padlocks**

Padlocks or other approved locking devices for equipment supplied under this contract shall be provided upon completion of the contract works.

All padlocks and other locks shall be provided with two identical operating keys. Each key shall have an engraved durable identification label. It shall be impossible to open any lock or padlock with the key of any other lock or padlock provided under this contract. Keys and locks shall be impressed with the manufacturer's special serial number.

### **1.34.4 Tools**

On completion of the contract works, the Contractor shall supply two complete sets of tools (and, when particularly specified, portable indicating instruments) for the safe operation and safe maintenance of all the plant and equipment. He shall also provide suitable means of identifying and storing such tools, complete with a suitable means of securing.

### **1.34.5 Spares**

The Contractor shall at practical completion supply the following spare parts and loose material. In all cases the Contractor shall hand the materials to the person responsible for the building, i.e. Head teacher, Building Manager, etc., and shall obtain a signed receipt in duplicate listing all items handed over.

#### **1.34.5.1 Exchange Pulleys and Belts**

Include for one spare set of exchange pulleys and belt drives for each belt driven fan and pump installed within the scope of the contract. Belts shall be clearly labelled and hung on a back board in the respective plant room.

#### **1.34.5.2 Air Filters**

Include for supplying and fitting new air filters to the air handling plant after testing and commissioning is satisfactorily completed and before handover.

### **1.34.6 Practical Completion**

The Contractor shall ensure that the whole of the installation has been tested and commissioned and shall be ready for operation by the date required by the works contract programme.

Practical completion of the Contractor's works or agreed phase of the works will not be given until the Contractor has fulfilled their obligation under the Contract conditions, and in particular demonstrated to the satisfaction of the CA that the following are complete:



- All works are complete other than minor defects which could be reasonably completed within an agreed program without causing disruption to the use of the building or agreed part. The CA shall be the sole arbiter of what may be considered 'minor', "reasonably completed", "an agreed program" and "disruption to the occupier".
- All tests and demonstrations have been satisfactorily undertaken in the presence of the CA.
- All final copies of the record/as built drawings, schedules, operating and maintenance manuals and 'Part L' log books have been supplied in a format agreed by the CA.
- All spares, keys, tools, oils, chemicals and other materials required for the running and maintenance of the building services systems have been supplied.
- All instructions and training of the occupier/Employer's staff have been satisfactorily completed.
- All documentation required for the Health and Safety File have been provided as required by the CDM Regulations.

Practical Completion Certificate shall not be issued until the final and approved O&M Manuals and Record Drawings and documentation has been submitted.

The Contractor shall notify the CA, in writing of the date of completion and handing over of the whole or part of the works so that the date for commencement of the maintenance and defects liability period can be agreed. Failure to do this may involve the Contractor in an extended maintenance and defects liability period. When the whole of the works have been completed, tests have been carried out and the required operating and maintenance instructions and the manuals and record drawings have been handed over to the CA, then the maintenance period shall begin. The CA will confirm the receipt of documentation who will then issue a Certificate of Practical Completion at the time the building is handed over.

#### **1.34.7 Tuition and Training**

The Contractor shall provide tuition and training for those representing the building user and/or Employer and the Maintenance Contractor.

Tuition and training shall be carried out at practical completion and repeated, by agreement no more than four months after practical completion.

When the tuition and training programmes are completed and demonstrated satisfactorily to the Client/end user, the appropriate form included in the project specification appendices shall be signed accordingly.

Training shall be carried out in two parts as detailed below:-

#### **1.34.8 User Training**

This is for the building user/occupier, and shall be carried out at once at Handover and once during the defects liability period as a refresher.

The Contractor shall provide trained and experienced personnel to fully instruct the Building Manager and/or their representative, in all aspects of the operation & control instructions for the building services installation, its plant, equipment & systems.

Any instructions for equipment, plant & controls are to be provided in a simplified format, and encapsulated with a duplicate copy fixed adjacent to respective control panels.

#### **1.34.9 Maintenance Contractors' Staff Training (Where Applicable)**

Allowance shall be made to provide trained and experienced personnel to fully instruct the Maintenance Contractor in the operation of all the building services installation, its plant, equipment & systems installed or modified as part of the contract.

This shall be carried out at the end of the maintenance & defects liability period, & before the Certificate of Making Good Defects is issued and as detailed below:-

The contractor shall:



1. include for a minimum of five days (unless specified otherwise in the contract preliminaries or Particular specification) for plant operation and to instruct the maintenance staff, as described above, in the day to day running and maintenance of the plant, systems and equipment. This shall include demonstrating and comprehensively explaining the function of all plant, systems and equipment listed and detailed in Record Documents to the Employer's satisfaction.
2. arrange for, and include the costs associated with, attendance of manufacturers or suppliers representatives as necessary.
3. allow for the fact that the period of instruction may not necessarily take place immediately upon Practical Completion but when considered desirable by the Employer.
4. allow for a further two day period of instruction during either the Summer or Winter whichever is not covered by the initial period.
5. ensure that each manufacturer or supplier of motive plant or equipment or controls includes all costs associated with instructing and training of Employer's staff.
6. allow for the automatic controls and BMS specialist to give detailed instructions and training to the building user and CA during the commissioning stage. This shall be repeated within the first month after handover, 6 months into the defects period and also at the end of the defects period.

The Contractor shall obtain a signature from the CA, and the Maintenance Contractor (where applicable) to signify that operating instructions have been given & understood. This is to be included within the operation and maintenance manual.

#### 1.34.10 Rectification Liability Period

All Installation, materials, equipment and manufacturers warranties are to commence from issue of the Certificate of Practical Completion. The Contractor shall make good at their own expense any defects in workmanship, materials and equipment, fair wear and tear expected.

The Contractor shall bear any expense by the Employer as a direct result of defects. The Rectification Liability Period for the Services Installation shall be 13 months unless stated otherwise in the contract preliminaries. This rectification liability period will remain fixed regardless of the maintenance period associated with other contracts or main contracts for the works as a whole.

The Contractor shall advise the CA when all outstanding items and defects have been completed or rectified in order that a final inspection may be carried out.

At the end of the Rectification Liability Period under the conditions of the contract, the CA will confirm to the Contractor that there are no outstanding defects. The CA will then issue a Certificate of Making Good Defects.

#### 1.34.11 Maintenance, Servicing & Certification (Within the Warranty/Rectification Period)

The Contractor shall include within their tender submission, a full 13 month on site maintenance and servicing of the equipment and plant installed within the scope of the contract works.

The schedule shall be completed by the Contractor showing the number of visits and respective dates during the warranty period.

The servicing and maintenance shall be in accordance with the manufacturers requirements and shall also include the following:-

Plant	Frequency
Boilers	6 monthly
Air plant - filter change and fan pulley adjustment	Quarterly
Pumps & fans	1 per year
Pressurisation and booster sets	1 per year
Mixing valves	6 monthly



Chillers	1 per year
Gas safety inspection	On or up to 7 days prior to the date of the 1st year anniversary of the gas plant commissioning / servicing certificate issued prior to practical completion and included in the O&M Manual

Costs shall be inclusive of the following:-

- full training costs for personnel to take over the plant at the end of the 12 month period,
- full record of operating and maintenance procedures undertaken for all the plant items installed,
- the cost of replacement parts as scheduled for the planned maintenance programmes including the provision of clean air handling filters at handover and cleaning or replacing the filters appropriately during the 12 month warranty.
- water treatment chemicals required for normal operation during this period and records of all maintenance carried out by the Contractor shall be handed to the building's responsible person for inserting into and recording in the Building Log Book.
- testing refrigerant systems according their charge volumes and issuing compliance certificates to the Building Manager for inclusion in the Log Book.

It shall be the Contractor's responsibility to maintain the electrical services until the end of the rectification liability period and completion certificate is issued.

Where extended warranties of plant are required from manufacturers and/or suppliers, these shall be declared within this separate price. The Contractor is advised to ensure that all risks are covered so that all operating and maintenance carried out during the 12 month warranty period does not invalidate manufacturers' warranties.

When an agreed contract includes the first 12 months maintenance, the Contractor shall submit a programme to the CA for carrying out these works for agreement prior to Practical completion.

### 1.35 O & M Instruction Manuals and Record Drawings

#### 1.35.1 Introduction

14 days prior to practical completion the Contractor shall submit to the Building Services Engineer a draft copy of the proposed Operating and Maintenance Instructions of the Building services installed for comments. It shall include all the information necessary to provide for the safe and efficient operation and maintenance of the engineering services which comprise these works.

The manual shall meet the requirements of the following: BSRIA BG 1/2007 and follow the guidance and proformas set out in Part 2. It shall meet the requirements of BS EN 82079-1:2012 Preparation of instructions for use. Structuring, content and presentation. General principles and detailed requirements and BS 4940-2:1994 Technical information on construction products and services: Guide to content and arrangement.

Manuals shall be either Class B or Class D as described in BSRIA BG 1/2007. The appropriate type of manual shall be specified in the Particular Specification or on the drawings. Where not so specified the manual shall be Class B.



### 1.35.2 Class B Manuals

Class B manuals shall generally comprise:

- Record drawings and drawing symbols.
- Manufacturer's operating and maintenance instructions.
- Test and commissioning certificates.
- Warranties.
- Equipment inventories with manufacturers names and addresses.

A Class B manual may be prepared by the Contractor.

### 1.35.3 Class D Manuals

Class D manuals shall comprise the contents detailed in BSRIA BG 1/2007, which shall generally be as follows:

- How to use the manual
- Emergency information
- Contractual and legal information
- Systems description and design intent
- Asset list/equipment schedule
- Parts identification and recommended spares
- Spares policy
- Commissioning data
- Operation
- Maintenance recommendations and records to date
- Fault finding
- Lubrication
- Modification information
- Disposal instructions
- Names and addresses of manufacturers
- Index of plans and drawings
- Manufacturer's literature

A Class D manual shall be prepared by a specialist author as recommended by BSRIA or as approved by the Contract Administrator.

Both classes of O & M manual shall include full details of startup and shut down procedures, any necessary schematic drawings showing the location of control valves and plant etc., including where appropriate coloured drawing to indicate areas of zoning. Also included shall be copies of valve charts.

On receipt of the above information the Building Services Engineer shall formally comment within two weeks. The Contractor shall incorporate all such comments and issue a further

Updated copy to the Building Services Engineer for final comment within one week of receipt of documents.

The Contractor shall handover to the Employer's representative four hard copies and one CD of Operating and Maintenance Instructions NO LATER than the date of practical completion.

Practical Completion may be withheld until the O & M manual has been substantially provided.

Operating and Maintenance Instructions shall be indexed and contained in ring binders with stiff covers. The name of the Site shall be printed on the front and spine with, where more than one volume is necessary, a suitable identification title. The date of completion of the Works shall be included on a flyleaf. The Instructions shall be fully cross-referenced and co-ordinated with the Record Drawings.





If the documentation is not completed to the full satisfaction of the Engineer the Employer shall be entitled to have the manuals prepared by another firm or company and recover the full costs incurred from the Contractor. No claim for payment will be entertained for manuals partially completed.

#### **1.35.4 Building Logbook / Instructions (For Use of the Dwelling)**

In order to satisfy the requirements of The Building Regulations Approved Document Part L2 Section 3, the Contractor shall be fully responsible for the preparation, production and submission of all information required to fulfill the contract requirements for the production of a Building Log Book.

The Contractor shall be responsible for obtaining and coordinating the relevant information in conjunction with the Engineer and Contract Administrator.  
Failure to produce the required format for the Log Book at the appropriate time may result in Building Regulations approval not being granted. It is therefore imperative that due allowance is made within the tender for this element of work.  
The information to be provided by the Contractor shall be in accordance with the guidelines set down in the by CIBSE Technical Memorandum TM31.

The Building Log Book is a single copy of a separately produced document and should not be confused with the any other document.

The CIBSE approved format (TM31), The Building Log Book Toolkit should be used as the basis to present the required information.

As a minimum, the format of the Building Log Book will be as follows:

- Proforma sheet for Log Book Updates & Annual Reviews
- Introduction, Purpose & Key Responsibilities
- Links to other Key Documents
- Statement of Calculation Results and Assessment for Carbon Emissions
- Conceptual Design Overview
- Key Operational & Energy Saving Do's & Don'ts Schedule to Optimise the Design Philosophy
- Energy Metering, Monitoring, Targeting Strategy (using TM39). Including Metering Schedule & Schematic.
- Summary of overall fossil fuel consumption & CO<sub>2</sub> against simple benchmarks.

Due to its nature, much of the required information will be required to be produced by the SBEM Assessor/SAP Assessor and implemented as part of the scheme. The Contractor shall be required to collate all relevant information. Information submitted by the Contractor shall be submitted in draft format 5 weeks prior to practical completion to provide the Contract Administrator sufficient time to review and return comments. The final information shall be produced 2 weeks prior to Handover to enable sufficient time for the collation/production of the completed Building Log Book.

#### **1.35.5 Building Logbook / Instructions (For Use in New Buildings)**

The building logbook should provide enough detail of installed plant, controls, method of operation, maintenance which will allow energy consumptions to be monitored and managed effectively. The information should be provided in a summary form suitable for day to day use. The logbook is intended to enable the building occupier to operate the building in an energy-efficient manner in accordance with the design intent. It should include:

1. Description of the building and design philosophy
2. Location of plant. instructions and simplified schematic diagrams
3. Target emission rate (TER) and building emission rate (BER) calculations
4. Location, description and instructions for any energy meters



### 1.35.6 Building Logbook / Instructions (For Use in Existing Buildings)

A new or updated building log book should inform:

1. Location of new plant, instructions and simplified schematic diagrams
2. Location, description and instructions for any new energy meters
3. Any other details that collectively enable the energy consumption of the building and building services covering the works to be monitored and controlled.

The Electrical Sub Contractor shall provide information about the building in accordance with the requirements of Part L1A and L1B of the Building Regulations. This should provide the occupier of the building with sufficient information about the building and the fixed building services to allow them to operate the building using no more fuel or power than is reasonable in the circumstances.

This can be done by provided a suitable set of instructions aimed at achieving economy in the use of fuel in terms that the building manager can understand in a durable format that can be kept for the life of the equipment.

### 1.36 Equipment Suppliers

The Contractor shall The Contractors attention is brought to the selection of equipment suppliers as denoted in the Particular Specification.

This statement of suppliers/Sub-Contractors shall be not deviated from during the contract period without reasonable cause and written approval of the Contract Administrator.

Failure to provide a full comprehensive list of Sub-Contractors/supplies at Tender may invalidate the Contractors Tender.

### 1.37 Builders work

In the absence of any clauses written within the Main Contractors Preliminaries, all builders work associated with the electrical services installation shall be deemed to be undertaken by the Main Contractor with the exception of the following which shall be undertaken directly by the Electrical Contractor.

- a) The drilling of all holes for support fixings.
- b) The drilling of all holes for services penetrations up to and including 100mm. All holes above 35mm shall be agreed with the Structural Engineer prior to forming.
- c) Note: When drilling holes for small penetrations through floors, and walls, the machinery must not vibrate due to the makeup of the floor, and all holes must be at least one and a half diameter between holes to prevent deformation and cracking of the concrete.
- d) The fabrication of all specialist plant and services supports unless specifically stated otherwise. Such supports shall be complete so as to allow for the support of services from principal structural elements of the building.
- e) The infill of plant inertia pouring bases.
- f) The Contractor is further referred to in Section One of this Specification where the production of builders work drawings is detailed.



### 1.38 All Accessories Necessary

For the purpose of this specification the term “all accessories necessary” shall mean all components, software, supports, controls, sundry items and accessories necessary to be provided to ensure that the item of plant, installation or equipment in question may be set into continued operation accordance with both the specific and intended requirement of this specification by the Contractor.

The Contractor shall therefore provide all accessories necessary that without which the item of Plant, installation or equipment in question would not be operable to the satisfaction of the Engineer. The Contractor shall allow for the supply, off-loading, erection, installation, testing, commissioning, setting to work and maintenance of the full electrical services as detailed in this specification, the contract drawings and including, but not necessarily limited to, the following:-

- a) Co-ordination of Incoming Electricity and Telecommunications Supplies.
- b) Main and sub-distribution electricity switchgear and cabling Installations
- c) Final circuit installations.
- d) Internal and External general and emergency lighting installations
- e) Internal and External automatic and manual lighting control installations
- f) Production lighting installations
- g) Internal and External small power and general power installations including the provision of power supplies to certain fixed equipment and items of mechanical plant
- h) Production small power and ancillary services installations
- i) Voice and data cabling networks and certain active component installations
- j) Classroom and teaching space audio / visual teaching aid fixed cabling
- k) Access control, entry phone, e-registration, cashless vending and library administration installations including the provision of all system software
- l) Intruder detection installation
- m) Closed Circuit Television recording and reporting installations
- n) Multi-zone public address and in certain areas sound reinforcement installations
- o) Automatic fire detection and annunciation installation
- p) Disabled persons place of refuge and WC alarm systems
- q) Wiring of Natural and Smoke Ventilation installations and provision of certain control equipment.
- r) Provision of Hearing Support Systems.
- s) Methane Gas detection and monitoring installation
- t) Earthing systems



- u) TV signal distribution installation
- v) Installation certification
- w) As Installed and Record documentation.
- x) Provision of 13 months installation maintenance commencing on agreed date of practical completion of Electrical services.

### **1.39 Craneage**

The Contractor shall provide his own craneage facilities and labour assistance for the lifting of plant and equipment into position. Within fourteen days of his appointment the Contractor shall provide the Main Contractor with his anticipated craneage details giving anticipated loads and delivery dates. The Contractor shall be responsible for serving all necessary notices to Local Authorities, police and any other Statutory Bodies including payment of any charges arising there from.

### **1.40 Testing and Commissioning**

The Contractor shall include and be responsible for the setting up, testing, commissioning and setting to work the whole of all installations as on the Contract Drawings and as described in this Specification.

Approved specialists shall be employed to provide and commission the relevant system(s) software to ensure full accessibility through and co-ordination with the employer's administration software.

In the event of sectional testing, the Contractor shall allow for and provide, fix and adequately support all necessary temporary cabling, software modification etc. to facilitate the sectional commissioning and operation of the relevant building section. On completion of all building sections the works shall include the removal of temporary links etc. and final commissioning, re-commissioning and re-programming to suit a single operational site.

### **1.41 Acceptance Tests**

The Contractor shall include, and be responsible for, the carrying out of acceptance tests before final handover of the services installation. The acceptance tests shall prove the following:

- a) All systems fully compliant with Building control requirements.
- b) All systems are fully operational (where appropriate through the employers front end administration software).

### **1.42 Maintenance**

The Contractor shall allow for undertaking the first full 12 months preventative maintenance works for the entire installation, following the date of handover. The Contractor shall provide emergency call-out cover with suitably qualified operatives attending the site within 4 hours of receiving the call. The Contractor shall allow in his price for all consumables.

### **1.43 Operating and Maintenance Manuals and Record Drawings**

The Contractor shall provide a comprehensive operating and maintenance manual and record drawings covering all systems installed under the sub-contract and as detailed elsewhere in this specification.



#### 1.44 Samples

Where required within the Main Contractors preliminaries or where requested within the particular specification, the Electrical Contractor shall arrange for samples of all equipment which will eventually be visible, to be brought to the Pre-Contract meeting for agreement with the Client/Architect before any items are ordered.

Samples to include, luminaires, accessories, fire alarm system / public address / access control / disabled persons place of refuge & WC alarm / CCTV / AV system, Classroom teaching system components etc.



## 2.0 MATERIALS AND WORKMANSHIP

### 2.1 Low Voltage Switchgear

#### 2.1.1 General Requirements

Low voltage switch panels shall be designed manufactured, tested and installed in accordance with BS EN 61439-2:2009 Low-voltage switchgear and control gear assemblies. Power switchgear and control gear assemblies and as detailed in Section Four of this specification.

##### Internal Separation

The form of internal separation shall be as defined in the "Guide to Forms of Separation" as published by The Electrical Installation Equipment Manufacturing Association.

##### Site Built Assemblies

Site built assemblies shall be of a proprietary system by one manufacturer and installed in accordance with the manufacturer's instructions.

##### Cubical Type Assemblies

Cubical-type assemblies shall be of the multiple cubical-types and shall be either wall or floor mounting.

##### Auxiliary Wiring

Auxiliary wiring shall be to BS 6231:2006 Electric cables. Single core PVC insulated flexible cables of rated voltage 600/1000 V for switchgear and control gear wiring and shall terminate in rail mounted moulded terminal blocks with fully shrouded connectors.

Each terminal shall be fitted with an identification tag fitted into moulded tag slots.

#### 2.1.2 Moulded Case Circuit Breakers

Moulded case circuit breakers (MCCB) shall comply with BS EN 60947-2:2017 Low-voltage switchgear and control gear Circuit-breakers Category B.

MCCB shall be provided with thermal and magnetic trip devices which shall be fixed up to a rating of 125A and adjustable above 125A.

MCCB's shall have an adequately rated, service and ultimate breaking capacity.

#### 2.1.3 Air Break Switches

Air break switches shall comply with BS EN 60947-2:2017 Low-voltage switchgear and control gear Circuit-breakers

Fuse switches and fuse switch combination units shall be fitted with BS 88 HRC fuses.

Isolator switches shall be of the rotary type having either die cast aluminium or sheet steel enclosures. Motor isolators shall be adequately rated to AC23. Direct on line started motors isolators shall have three poles and star-delta started motor isolators shall have six poles.

Where the starter is located in a remote panel the isolator shall be fitted with an ancillary pole connected to the starter circuit.

All air break switches shall be lockable in the off position.



#### **2.1.4 Air Circuit Breakers**

Air circuit breakers ACB's shall comply with BS EN 60947-2:2017 Low-voltage switchgear and control gear. Circuit-breakers and shall be metal clad with drawable type Category B.

The closing mechanism shall be of the independent manual spring type.

Tripping shall be by Mechanical spring

Each ACB shall be provided with interlocks to prevent movement of the circuit breaker within the housing when in "closed" or "service" position.

Automatic shutters shall be provided to cover all live contacts when the circuit breaker is isolated, withdrawn or removed from the housing.

A padlock shall be provided to lock the circuit breaker in the isolated/withdrawn position and to lock the automatic shutters covering live contacts when removed from its housing.

#### **2.1.5 Current Transformers**

Current transformers (CTs) shall comply with BS EN 61869-2:2012 Instrument transformers. Additional requirements for current transformers

CTs shall be dedicated to and be fully compatible with the protection device, instrument or meter.

Test links shall be provided in the secondary connections of all CTs to facilitate testing of instruments, meters and protective devices.

#### **2.1.6 Meters**

Electrical measurement meters shall be to 19/30350370 DC BS EN IEC 62053-23. Electricity metering equipment (a.c.). Particular requirements. Part 23. Static meters for reactive energy (classes 2 and 3) panel mounted and complete with selector switches as appropriate.

All meters shall be of an appropriate scale to enable the maximum accuracy under normal operating conditions.

#### **2.1.7 Enclosures**

Unless otherwise detailed, enclosures shall provide a minimum degree of protection of IP21 when located in buildings and IP43 when located outside buildings, or in 'wet' areas. Fixing holes for equipment inside buildings shall be inside the enclosure. Equipment to be located outside buildings or in 'wet' areas shall have fixing lugs external to the enclosures.

Enclosures shall be structurally stable and rigid under all operating conditions and shall be manufactured from material suitable for the environmental conditions.

#### **2.1.8 Distribution Boards**

MCB distribution boards shall be to BS EN 61439-3:2012 Low-voltage switchgear and controlgear assemblies. Distribution boards intended to be operated by ordinary persons and shall be complete with all MCB's of the type and rating as detailed in the schedule of distribution boards.

MCB's shall be manufactured to BS EN 60898-1:2019 Electrical accessories. Circuit-breakers for overcurrent protection for household and similar installations. Circuit-breakers for a.c. operation of the appropriate type with an adequate rated short circuit capacity.

Consumer units shall be of the MCB type to BS EN BS EN 61439-3:2012



HRC fuse type distribution boards shall be to BS EN 61439-3:2012 and shall be completed with HRC fuse links to BS88 as detailed in the schedule of distribution boards.  
Distribution boards shall be fully shrouded and provided with blanks to cover all spare ways.

Each distribution board shall be provided with a lockable overall cover.

Distribution boards located remote from the main switchgear shall be fitted with a main isolator of the rating indicated on the drawings.

Where circuits are indicated as being protected by a residual current device (RCD) these shall be Integral with the distribution board and space allowance shall be made as appropriate.

Each distribution board shall be fitted with a typed circuit chart which shall be incorporated in a non-flammable transparent envelope security fixed to the internal side of the distribution board door. The chart shall indicate:-

- Distribution board reference
- The measured earth loop impedance and prospective short circuit current of the distribution board
- Out-going protective device type and rating
- Circuit details
- Cable size and type.

The circuit chart shall also indicate any circuits to which sensitive electronic equipment are connected, which may be damaged by insulation tests.

Where the physical size of the distribution board precludes the installation of the chart within the distribution board door, the chart shall be provided with a timber frame and glass cover securely fixed to the wall adjacent the distribution board.

## 2.2 Wiring Systems

### 2.2.1 Steel Trunking

#### Materials

Steel cable trunking and fittings shall be manufactured from heavy gauge sheet steel to BS 4678, Part 1 having a return edge and a minimum gauge of:-

Size	Gauge
Up to 75mm. x 75mm. or equivalent cross sectional area	1.2mm.
Above 75mm. x 75mm. or equivalent cross section area	1.6mm.

Steel underfloor trunking shall be to BS 4678-2:1973 Cable trunking. Steel underfloor (duct) trunking.

Cable trunking shall have a finish to Class 1, i.e. Electro plated zinc having a minimum thickness of zinc coating of 0.0012 mm inside and outside.





The trunking system shall be mechanically and electrically continuous throughout the fully complete with overlapping lid, couplings, end caps etc. Only factory made fittings shall be used, site manufactured tees, bends etc. will not be allowed. All accessories shall be of the same gauge and finish as the trunking body.

Each section of trunking and accessories shall be connected by a tinned copper earth continuity link.

Purpose made 'pin racks' shall be installed in vertical rising trunking at intervals of 3000 mm to support the weight of the cable. The 'pin racks' shall be PVC coated.

### Installation

Trunking shall be installed neatly running truly vertical, horizontal and parallel with the features of the building and shall not be run closer than 150 mm to any other non-electrical service.

Cable trunking shall only be installed in areas which allow it to be fully accessible.

All cable trunking shall be properly supported at the maximum distances detailed in the table below or as otherwise detailed on the drawings.

Cross Sectional Area of Trunking (mm <sup>2</sup> )	Maximum Distance Between Supports	
	Horizontal (m.)	Vertical (m.)
Exceeding 300 and not exceeding 700	0.75	1.0
Exceeding 700 and not exceeding 1500	1.25	1.5
Exceeding 1500 and not exceeding 2500	1.75	2.0
Exceeding 2500 and not exceeding 5000	3.0	3.0
Exceeding 5000	3.0	3.0

Where trunking is fixed to parts of the structure which is liable to movement the trunking shall incorporate a flexible coupling. A protective conductor shall be firmly connected to each end of the flexible coupling to maintain the earth continuity of the trunking system.

All fixing screws within the trunking shall have round heads, to prevent abrasion or cutting of cables, and shall be of adequate size. The trunking shall be free of any sharp edges.

Where a trunking passes through a wall or floor, a short section of lid shall be fitted to the trunking which shall protrude a maximum of 50 mm either side of the wall or floor. Prior to trunking being installed through a load bearing wall or floor the approval of the Structural Engineer will be required.

Fire barriers shall be installed in the trunking as required by IEE Regulation 527-02. Fire barriers within trunking shall be of the removable intumescent sock or similar principle to provide for the same fire separation rating as that relating to the surrounding wall. Fire barriers within cable trunking shall be supplied and installed as part of the electrical contract works.

Care shall be taken to ensure that all bends are of sufficient radius to ensure the minimum recommended bending radius of the cables to be installed within the trunking is complied with. Gusset type bends shall be used where possible.



Flanged connectors shall be used to terminate trunking into equipment or enclosures. The opening into the equipment or enclosure shall be the same as the internal size of the flanged connector and the edge of the opening shall be bushed to avoid cable abrasion.

## 2.2.2 Insulated Cable Trunking

### Materials

Insulated cable trunking and fittings shall be manufactured from heavy gauge UPVC to BS 4678-4:1982, having non flame propagating properties.

Insulated cable trunking for use with PVC insulated unsheathed cables shall be suitable for use as supplementary insulation.

The trunking system shall be mechanically and electrically continuous throughout and fully complete with overlapping lid, couplings, end caps etc. Only factory made fittings shall be used, site manufactured tees, bends etc., will not be allowed. All accessories shall be of the same gauge and finish as the trunking body.

Purpose made 'pin racks' shall be installed in vertical rising trunking at intervals of 3000 mm to support the weight of the cable. The 'pin racks' shall be PVC coated.

### Installation

Trunking shall be installed neatly running truly vertical, horizontal and parallel with the features of the building and shall not be run closer than 150 mm to any other non-electrical services.

Where trunking is run with 'lid down' purpose made preparatory cable retaining clips shall be installed at 1000 mm centres.

Cable trunking shall only be installed in areas which allow it to be fully accessible.

All cable trunking shall be properly supported at the maximum distances detailed in the table below or as otherwise detailed on the drawings:-

Cross Sectional Area of Trunking (mm <sup>2</sup> )	Maximum Distance Between Supports	
	Horizontal (m.)	Vertical (m.)
Exceeding 300 but not exceeding 700	0.5	0.5
Exceeding 700 and not exceeding 1500	0.5	0.5
Exceeding 1500 and not exceeding 2500	1.25	1.25
Exceeding 2500 and not exceeding 5000	1.5	2.0
Exceeding 5000	1.75	2.0

Where trunking is fixed to parts of the structure which is liable to movement the trunking shall incorporate a flexible coupling.

All fixing screws within the trunking shall have round heads, to prevent abrasion or cutting of cables, and shall be of adequate size. Each fixing screw shall be provided with a brass washer.



Where a trunking passes through a wall or floor, a short section of lid shall be fitted to the trunking which shall protrude a maximum of 50 mm either side of the wall or floor. Prior to trunking being installed through a load bearing wall or floor the approval of the Structural Engineer will be required.

Fire barriers shall be installed in the trunking as required by IEE Regulation 527-02. Fire barriers within trunking shall be of the removable intumescent sock or similar principle to provide for the same fire separation rating as that relating to the surrounding wall. Fire barriers within cable trunking shall be supplied and installed as part of the electrical contract works.

Care shall be taken to ensure that all bends are of sufficient radius to ensure the maximum recommended bending radius of the cables to be installed within the trunking is not exceeded. Gusset type bends shall be used where possible.

Flanged connectors shall be used to terminate trunking into equipment or enclosures. The opening into the equipment or enclosure shall be the same as the internal size of the flanged connector and the edge of the opening shall be bushed to avoid cable abrasion.

Insulated trunking shall be installed strictly in accordance with the manufacturer's recommendations.

Fittings shall be provided with internal couplers. All joints shall be made using a solvent adhesive. Expansion joints in accordance with the manufacturer's recommendations shall be made at 6000 mm centres. Fixing holes shall be elongated to allow for linear expansion.

### 2.2.3 Steel Conduit

#### Materials

Conduits and conduit fittings and accessories shall comply with:

BS EN 61386-1:2008 Conduit systems for cable management. General requirements,

BS EN 60423:2007 Conduit systems for cable management. Outside diameters of conduits for electrical installations and threads for conduits and fittings,

BS EN 61386-21:2004+A11:2010 Conduit systems for cable management. Particular requirements. Rigid conduit systems

BS EN 61386-1:2008 Conduit systems for cable management. General requirements and be of the heavy gauge, seam welded, steel tube screwed, having a Class 4 hot dip galvanised finish.

Fittings shall be malleable iron and shall be of the same class of finish as the associated conduit system. Manufactured type elbows and bends shall not be used. All conduit boxes shall be fitted with lids secured by dome or cheese headed screws steel for class 2 finish and brass for class 4 finish.

All conduits shall be properly supported with spacings between supports not exceeding the following table.

Nominal Size of Conduit (mm)	Maximum Distance Between Supports	
	Horizontal (m)	Vertical (m)
Up to 25mm.	1.75	2.0
25mm. to 40mm.	2.0	2.25
Exceeding 40mm.	2.25	2.5

A draw-in box shall be provided in all conduit runs exceeding 10 m in length or containing more than two right angle bends.



All open ends left during the construction of the works shall be temporarily plugged to prevent the ingress of foreign matter, moisture or water.

Bends and sets shall be formed in conduits using a pipe bending machine fitted with the correct size former. The minimum bending radii of every conduit shall comply with IEE Regulation 522-08-03.

Conduits shall be threaded using correct size dies. Prior to final assembly of the joint/termination the threaded section shall be wiped clean of all cutting oil, reamed, burrs removed and graphite paste applied to all threads.

Where the conduit is to be used as a protective conductor, special care shall be taken to ensure all joints and terminations create an effective bond.

The length of thread on conduit shall suit the length of internal thread in the end of the fitting or accessory. Exposed thread shall be kept to a minimum.

Any exposed threads along with any superficial damage to the finish of any conduit shall be made good by painting with a coat of rust inhibitor metal primer and two coats of final paint (colour to match finish of conduit). Any damaged conduits will not be accepted and shall be replaced.

Surface mounted conduit and conduits in accessible locations, e.g. above suspended ceilings, shall be fixed using spacer bar saddles conduit runs shall be planned and installed to be as neat and unobtrusive as possible.

Extension collars shall be fitted as necessary to ensure boxes are flush with finished surface.

Conduits run at high level in portal frame or similar buildings shall be fixed using proprietary fixing system as 'caddy clip' or equal and approved.

## **2.2.4 Insulated Conduit**

### Materials

Conduits and conduit fittings/accessories shall comply with BS EN 61386-21:2004+A11:2010 and be of a super high impact heavy gauge type of one colour only throughout the system.

Conduits less than 20 mm diameter shall not be used.

Manufactured type elbows and bends shall not be used.

All conduit boxes used to support equipment shall be provided with steel screw thread inserts which shall take the weight of the equipment. Where the weight of the equipment exceeds 3 kg or the temperature at the equipment exceeds 60oC a metal box shall be provided.

All conduit accessory boxes shall be provided with an earth terminal.

Termination at accessories shall be made into steel boxes as manufactured to BS 4662:2006+A1:2009 Boxes for flush mounting of electrical accessories. Requirements, test methods and dimensions

### Installation

Conduits shall be installed neatly running truly vertical, horizontal or parallel with the features of the building and shall not be installed closer than 150 mm to any other non-electrical service.

Special care must be exercised to ensure conduits are kept away from hot water services and pipes.

Conduits shall be properly supported spacing between supports and shall not exceed 1000 mm for horizontal runs and 1.25 m for vertical runs. Supports shall be provided within 150 mm of boxes or bends.



A draw-in box shall be provided for all conduit runs exceeding 10 m in length containing more than two right angle bends.

All open ends left during the construction of the works shall be temporarily plugged to prevent the ingress of foreign matter, moisture or water.

Bends shall be formed in conduits using a method approved by the conduit manufacturer using an appropriate bending spring.

Fractured or 'kinked' conduit will not be accepted.

Conduits shall be cut using a proprietary tool to ensure a clean finish with no swarf being left within the conduit.

Joints into couplers and conduit boxes shall be made using a solvent adhesive. Any excessive solvent shall be removed.

Expansion couplers shall be provided at 6000 mm centres on long straight runs of exposed conduit.

Termination at accessories shall be made into steel boxes via an adapter/flange coupler and male screwed bush.

Surface mounted conduit and conduits in accessible locations, e.g. above suspended ceilings, shall be fixed using spacer bar saddles. Conduit runs shall be planned and installed to be as neat and unobtrusive as possible.

Conduits run at high level in portal frame or similar buildings shall be fixed using proprietary fixing system as 'caddy clip' or equal and approved.

## 2.2.5 Cable Tray / Ladder

### Materials

Cable trays shall be a minimum of 30% perforated type and shall be formed from hot rolled steel to BS 1449-1.1:1991 Steel plate, sheet and strip. Carbon and carbon-manganese plate, sheet and strip. General specification galvanised after manufacture to BS EN ISO 1461:2009 Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods

The tray shall be medium duty type having a return flange manufactured from the following gauge steel.

Nominal Width (mm)	Gauge (mm)
100	0.75
150	1.0
225	1.0
300	1.2
450	1.5
600	1.5
750	1.5
900	1.5

Only factory made accessories of the same type, gauge and finish as the tray system shall be used.



### Installation

Cable trays shall be supported at adequate centres using galvanised steel channel to prevent deflection.

Spacing of cable trays shall not be less than the following:-

Spacing			
Nominal Width of Largest Tray (mm)	Between & Back of Tray (mm)	Between & Soffit Above (mm)	Between Trays Stacked (mm)
W	0.1 x W	1.0 x W	2.0 x W

The tray work shall be arranged to minimise the number of cuts necessary. All cuts shall be made through unperforated metal and shall be painted with a zinc rich paint.

Any holes cut for the passage of cables shall be provided with brass bushes.

All bolted connections between tray lengths and accessories shall be made using round galvanised steel bolts to prevent damage to the cables.

Where cable trays / ladders pass through wall, floors or similar a suitable galvanised steel sleeve shall surround the cable tray and extend a minimum of 50mm beyond wall or slab surfaces, the purpose of the sleeve shall be to prevent builders making good compromising the present and future wiring space. The active present and future wiring space on the cable tray / ladder shall be fire stopped with suitably retained removable intumescent socks or similar principle, to provide for the same fire separation rating as that relating to the surrounding wall / slab. The non-active faces of the cable tray / basket shall be fire stopped with suitable semi-removable intumescent mastic or similar to provide for the same fire separation rating as that relating to the surrounding wall / slab. Fire barriers between cable tray / ladder and the surrounding sleeve shall be supplied and installed as part of the electrical contract works.

### **2.2.6 Wiring of Conduit and Trunking**

#### Materials

PVC insulated cables shall be used as specified in BS EN 50525-1:2011, BS EN 50525-2-31:2011, BS EN 50525-2-51:2011, BS 6004:2012 having copper conductors and insulation rated at 450/750 volt grade. No conductor size less than 1.5 sq. mm shall be used and all cables shall have stranded conductors only i.e.

for 1.5 sq. mm - conductor stranding is 7/0.53.

for 2.5 sq. mm - conductor stranding is 7/0.67.

Single solid conductors will not be allowed.

#### Installation

Wiring of conduits installed within the carcass of the building shall not be installed until the plaster and/or screed has dried and set and the interior of the conduit is dry.

The number of cables which are to be drawn into any conduit must be such that it allows easy drawing-in and in no circumstances shall it be in excess of the maximum given in IEE Guidance Note To assist drawing-in the cables shall be liberally smeared with french chalk. All cables shall be drawn-in simultaneously within crossovers. The cable reels shall be arranged on a stand or support so as the allow them to revolve freely as cables are drawn-in to the conduit. On no account shall cables be allowed to spiral off the reel.



Connections on all conductors shall only be made at accessories/switchgear positions. No other joints shall be allowed.

Cables installed in trunking shall be fitted with a circuit identification label, at every 5 m interval in straight lengths and at each trunking junction (e.g. Tees etc.).

The Engineer will inspect the wiring prior to the trunking lids being fitted and the accessories and equipment being connected. The Sub-Contractor shall inform the Engineer when the trunking lids etc. are to be fitted giving at least seven days prior notice.

Terminations of cables shall be carried out in strict accordance with the manufacturer's recommendations. Special care shall be taken to ensure that all conductors are firmly gripped. When terminating one conductor into a terminal tunnel the conductor shall double back to ensure a positive connection is made. All terminating conductors shall be left with some slack cabling.

All conductors shall be identified in accordance with IEE Table 51.

A separate circuit protective conductor of the size detailed in the schedule of distribution boards shall be provided in all insulated and flexible conduit systems.

### **2.2.7 Armoured Cables**

#### Materials

XLPE/PVC/SWA/PVC 600/1000 volt grade and shall be XLPE insulated, extruded PVC bedded, steel wired armoured, PVC sheath conforming to BS 5467:2016 Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1 000 V and 1 900/3 300 V for fixed installations

PVC/PVC/SWA/PVC 600/1000 volt grade and shall be PVC insulated, extruded PVC bedded, steel wired armoured, PVC sheathed conforming to BS 5467:2016 Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1 000 V and 1 900/3 300 V for fixed installations

Unless otherwise stated, all multi-core cables shall be complete with full size neutral.

Cable glands shall comply with BS 6121-5:2005 Mechanical cable glands. Code of practice for selection, installation and inspection of cable glands and armour glands and shall be provided complete with PVC cable shrouds and brass earth tags. All glands shall be 'C' type with an outer seal for internal and external use, providing a degree of protection to IP66.

LSF cables shall be terminated with low smoke and fume gland kits.

#### Installation

Cables shall be installed in accordance with the relevant British Standard and the manufacturer's recommendations.

Cables shall be delivered to site, and stored, on a cable drum with the manufacturer's label attached.

Cables shall be fixed to cable trays, the building fabric/structure, laid in trenches and installed in ducts as detailed on the drawings.

Cables shall only be installed when both the cable and the ambient temperature are above 0oC for PVC cables and -10OC for LSF cables and have been so for the previous twenty four hours, or where special precautions have been taken to maintain the cable above this temperature.

To facilitate the installation of cables the drums shall be supported by either Jack stands or a drum cradle to allow the cable to rotate freely whilst the cable is drawn through ducts laid in trenches or on cable trays.



Cables installed fixed to cable trays, racks or to the fabric of the building shall be fixed using proprietary cleats.

Cables having an overall diameter up to 50 mm shall be fixed by claw cleats. Cables over 50 mm overall diameter shall be fixed by two bolt cleats.

Cables shall be supported and fixed as detailed in the table below.

Overall Diameter of Cable (mm)	Maximum Spacing of Fixings	
	Horizontal (mm)	Vertical (mm)
Up to 15	350	450
15 to 20	400	550
20 to 40	450	600
40 to 50	900	1100
50 to 60	950	1100
60 to 70	1000	1200
70 and above	1200	1400

The minimum internal bending radius of the cables shall not be less than six times the cables overall diameter.

The current ratings of the cables shall be based on one of the following installation methods.

- a) On trays - Single layer of cables touching.
- b) In free air - As method 12 and 13 of IEE Regulations Table 4A.

Cables shall be installed only using these methods.

Joints in cables shall only be made at equipment and accessories.

Cables installed within trenches shall be laid at a constant depth of 500 mm below finished ground level, for low voltage cables 800 mm below finished ground level for high voltage cables.

Cable trenches shall be bedded with 75 mm of sieved earth or sand and shall be clear of any loose stones, prior to the cables being installed.

The Sub-Contractor shall be in attendance whilst the back filling is being carried out to ensure the cables are covered with a minimum of 100 mm of sieved earth or sand then well compacted, then filled in 200 mm lifts hand or power rrammed.

The Sub-Contractor shall install a continuous warning marker fuse 250 mm below finished ground level along the full length of the cable route.

Once cables have been drawn into ducts, all holes shall be sealed by a waterproof sealing compound to prevent the ingress of water, vermin etc.





Any coverings removed to facilitate terminations shall be made good by taping the gap between the PVC sheath and the termination and by extending the tape over the gland. The tape shall be applied "half lapped" and shall be fitted to all tape areas and PVC sheath and the gland (for external terminations) and fitted to extend over PVC sheath and the gland (for internal terminations). Gland shrouds shall be slotted over the cable before the gland is fitted.

When the termination is made into external equipment the gland shall incorporate a lead washer to ensure a watertight joint between the gland and the cut-out.

Steel wire armour will be used as the protective conductor. Care shall be taken at all terminations to ensure that the earth continuity is maintained. All glands, earth tags etc. shall be fitted and tightened to the manufacturer's recommendations. The earth tag shall be firmly fixed to the switchgear/equipment via a brass nut, bolt and shake proof washer. A protective conductor shall be connected and installed between the brass bolt and the earthing terminal and the switchgear/equipment.

Where cables pass through walls, floors, ceiling etc. the holes shall be made good with intumescent material to prevent the spread of fire. Where the walls, floors etc. form a fire barrier the cable shall be enclosed in a steel sleeve and the space around the cable in the sleeve shall be plugged with intumescent material to provide for the same rating of separation as the surrounding fire barrier wall, slab etc.

Single core armoured cables shall have non-magnetic armouring bonded at a single point only. The unbonded termination shall be made on to an insulated gland plate.

### 2.2.8 Mineral Insulated Cables

#### Materials

Mineral insulated cables and terminations shall comply with BS 6121-5:2005 Mechanical cable glands. Code of practice for selection, installation and inspection of cable glands and armour glands

Pre-insulated saddles shall be used to support the cables. On multiple runs of cable multi-way saddles shall be used and these shall be secured by brass round headed screws.

All accessory boxes shall be provided with an earth terminal.

#### Installation

Cables shall be installed neatly running truly vertical, horizontal or parallel with the features of the building and shall not be installed closer than 150 mm to any other non electrical service. Multiple runs of cables shall be installed without crossovers.

The fixing centres between saddles shall be in accordance with the following table:-

Overall Diameter of Cable (mm)	Maximum Spacing of Clips	
	Horizontal (mm)	Vertical (mm)
Up to 9	600	800
9 to 15	900	1200
15 to 20	1500	2000

The installation of cables shall be carried out in accordance with the manufacturer's recommendations and only tools recommended by the manufacturer shall be used to bend, set, dress or terminate the cables.



Where cables pass through floors and walls short lengths of conduit shall be threaded over the cable for protection. Holes around the conduit shall be made good with cement and the conduit shall be packed with intumescent material.

Where cables pass through steelwork, load bearing walls or floors, etc., the size and location of holes shall be agreed with the Structural Engineer.

Joints shall only be made at accessories, e.g. alarm sounders, break glass contact, no joints being allowed in straight runs of cable.

Standard temperature seals (105°C) and compression ring type glands shall be used at terminations. All cables shall be terminated in accordance with the manufacturer's recommendations. Cable seals shall not project into the interior of any accessory switchgear. Shrouds shall be fitted over the cable prior to termination.

At all terminations care shall be taken to maintain earth continuity. All glands and locknuts shall be efficiency fitted and tightened, to the manufacturer's recommendations. Particular attention shall be paid to surfaces of termination boxes which have been painted and the appropriate serrated lock-washers shall be used in such conditions to ensure earth continuity. The earth tail of the seal shall be connected to the earthing terminals within the box and accessories.

When terminating conductors special care shall be taken to ensure that all conductors are firmly gripped. When terminating one conductor into a terminal tunnel the conductor shall be doubled back to ensure positive connection is made. All terminating conductors shall be left with some slack cabling.

All conductors shall be insulated with 'neoprene' sleeving which shall be identified in accordance with IEE Table 51.

## **2.2.9 Insulated and Sheathed Cables**

### Materials

PVC insulated and sheathed cable shall comply with BS 6004:2012 having copper conductors and insulated rated at 300/500 volt grade. The cable shall incorporate a protective conductor. No conductor size less than 1.5 sq.mm. shall be used.

### Installation

Cables shall be run neatly and installed truly vertical, horizontal and shall not be installed closer than 150mm. to any other non-electrical service.

Cables shall be concealed within the fabric of the building, no surface installation being permitted.

All cables shall be installed in accordance with BS 7671:18th Edition (IET Wiring Regulations). Within ceiling voids the cables shall be supported by a purpose made cable stirrup. The grouping of circuits in any cable stirrup shall not exceed the maximum indicated in the Distribution Board Schedules.

Where cables pass through walls, floors, ceilings, partitions, etc., the holes shall be made good with intumescent material to prevent the spread of fire. Where the walls, floors, etc. form a fire barrier, the cables shall be enclosed in steel sleeve (conduit or trunking) and the space left inside the sleeve shall be plugged with intumescent material.

Where cables pass through steelwork, load bearing walls or floors, etc., the size and location of holes shall be agreed with the Structural Engineer.

At expansion joints in the building the cables shall be formed into a 100mm. long loop.



Where cables converge to enter distribution boards or other enclosures they shall be enclosed in steel cable trunking. The number of circuits contained within the trunking shall not exceed the maximum indicated in the Distribution Board Schedules.

The cable sheathing shall terminate inside the accessory.

A green/yellow PVC sleeve shall be fitted over bare protective conductors.

With this type of wiring system, where solid conductors are used on the smaller conductors, special care shall be taken when terminating conductors to ensure that all conductors are firmly gripped. When terminating one solid conductor into a terminal tunnel, the conductor shall be doubled back to ensure a positive connection is made.

All terminating conductors shall be left with some slack cabling.

## **2.2.10 Flexible Cables and Cords**

### Materials

Flexible cables shall be to BS EN 50525-1:2011, BS EN 50525-2-41:2011, BS EN 50525-2-42:2011. Flexible cords shall be to BS EN 50525-1:2011, BS EN 50525-2-11:2011, BS EN 50525-2-12:2011, BS EN 50525-2-21:2011, BS EN 50525-2-71:2011, BS 6004:2012, BS EN 50525-1:2011, BS EN 50525-2-11:2011, BS EN 50525-2-21:2011, BS EN 50525-2-51:2011, BS EN 50525-2-83:2011, BS EN 50525-3-21:2011, BS 6004:2012 and shall be suitable for the likely operating and ambient temperatures. Cords shall be colour identified as Table 51 of BS 7671:18th Edition (IEE Wiring Regulations).

Flexible cables and cords shall have a minimum conductor cross-sectional area of 0.75 sq.mm., be 300/500 volt grade and shall be circular construction with a white sheath unless otherwise stated.

### Installation

Flexible cords shall be used only for final connection to equipment and not part of the fixed wiring installation.

Cables and cords shall be installed in such a manner that no mechanical stress is put on the conductor connections. The weight supported by a flexible cord shall not exceed the manufacturer's recommendations.

Connection to equipment shall be via either purpose made connection boxes with cord grip or via an approximately sized compression gland.

## **2.2.11 Busbar Trunking**

### Materials

Bus bar trunking shall be manufactured in accordance with BS EN 61439-6:2012 Low-voltage switchgear and controlgear assemblies. Busbar trunking systems (busways) and the 18th Edition of the IEE Regulations, for use on a 415 volt 3 phase 4 wire 50Hz supply.

The bus bar shall be manufactured from high conductivity copper or aluminium.

The neutral conductor shall be full size unless otherwise detailed.

The whole assembly shall be manufactured to provide a minimum degree of protection to IP23 as defined by BS EN 60947-1:2007+A2:2014 or as otherwise detailed.

### Installation

Where dimensions are critical, site measurements shall be taken prior to manufacture.



The bus bar system shall be complete with all necessary accessories, e.g. feeder units, tapping boxes, end plates bends, tees, brackets and fixings etc.

The bus bar trunking shall be supported in accordance with the manufacturer's recommendations.

Expansion joints and anchor points shall be provided as necessary to the manufacturer's recommendation.

Where the trunking run crosses building expansion joints purpose made expansion units shall be fitted.

Fire barriers shall be provided where bus bar trunking passes through a fire resisting element of the structure, to prevent spread of fire.

### **2.2.12 Conductor Terminations**

Connections on all conductors shall only be made at accessory, switchgear or equipment positions. No other joints will be allowed.

Termination of conductors shall be carried out in strict accordance with the manufacturer's recommendations.

Care shall be taken when terminating conductors into accessories and equipment having clamping type terminal, to ensure a positive connection is made.

All conductors connected to bus bars and lug type connectors shall be terminated using compression lugs.

Compression lugs shall be selected to suit the conductor size only one conductor shall be terminated in each lug.

Compression lugs shall be crimped using a proprietary tool that cannot be released until the correct degree of compression has been achieved.

Compression lugs shall be securely fixed using an appropriately sized brass bolt, nut and locking washer.

All conduits shall be identified in accordance with IEE Regulations Table 51.

## **2.3 Luminaires and Lamps**

### **2.3.1 Luminaires**

#### Materials

All luminaires shall be manufactured to BS EN 60598:2018 series

Luminaires shall be supplied complete with all accessories, fixings, etc. necessary to provide a complete installation.

Thermoplastic translucent diffusers for recessed luminaires shall have a TP(a) classification as defined in Part B of the Building Regulation.

#### Installation

All luminaires shall be rigidly supported on independent supports to the building structure unless otherwise detailed.

Final connection shall be via a heat resistant flexible cord terminated via a compression gland.

Recessed luminaires shall be connected to the fixed wiring installation via a plug-in ceiling rose, mounted adjacent the luminaire in a fully accessible position.

All luminaires shall be installed strictly in accordance with the manufacturer's recommendations.



### 2.3.2 Control Gear

Fluorescent luminaires shall be complete with control gear to BS EN 61347 and BS EN 60921 for electro-magnetic and electronic ballasts.

Discharge luminaries shall be complete with control gear to BS EN 61347 and BS EN 60923.

All fluorescent and discharge luminaires shall have a power factor of not less than 0.85 lagging. Capacitors to BS EN 61048 and 61049 and shall be fitted with a fused terminal block by the manufacturer suitably rated to BS EN 60127-2. Starters shall be BS EN 60926 and BS EN 60927: 1991.

### 2.3.3 Lamp Holders

Lamp holders shall be manufactured to BS EN 61347-1:2015 and BS EN 60838-1:2017+A1:2017

Edison screw lamp holders shall be to BS EN IEC 60238:2018+A1:2018

### 2.3.4 Lamps

All luminaires shall be supplied complete with lamps complying with the following standards:-

Fluorescent double capped	:	BS EN 61195:1999+A2:2015, IEC 61195:1999
Fluorescent single capped	:	BS EN 60901:1996+A6:2017 and BS EN 61199:2011+A2:2015
LED	:	BS EN 61508-1:2010 - TC
Mercury vapour	:	BS EN 60188:2001+A11:2019
High pressure sodium vapour	:	BS EN 60662:2012+A11:2019
Low pressure sodium vapour	:	BS EN 60192:2001, IEC 60192:2001
Metal halide	:	BS EN 61167:2018+A1:2018
Tungsten filament	:	BS EN 60064:1995+A5:2009
Tungsten halogen	:	BS EN 60357:2003+A11:2016

### 2.3.5 Lighting Columns

#### Materials

Lighting columns shall be manufactured to BS EN 40-3-3:2013.

#### Installation

Lighting columns shall be securely installed in accordance with the manufacturer's recommendations and shall be level and plumb. Lighting columns shall be complete with fused cut-out units located in accessible enclosures in the base of each column.

### 2.3.6 Lighting Track

Lighting track shall be to BS EN 60570:2003+A1:2018 and supplied complete with all necessary proprietary fixings and accessories.



### **2.3.7 Extra Low Voltage**

All extra low voltage luminaires shall be fed via a safety isolating transformer to BS EN 61558-2-6:2009, BS EN 61558-1:2005+A1:2009 which shall be complete with overload and short circuit protection.

Multi-lamp transformers shall have voltage regulation to prevent over voltage on low load.

All underwater luminaires shall be fed via a separate transformer per luminaire or via a separate secondary winding on a multi-winding transformer.

## **2.4 Accessories**

### **2.4.1 Light Switches**

Light switches shall be manufactured to BS EN 60669-2-6:2012 and shall be 15/20A rated unless indicated otherwise.

### **2.4.2 Ceiling Switches**

Ceiling switches shall be to BS EN 60669-1:2018 complete with pull cord cut to the correct length.

### **2.4.3 Ceiling Roses**

Ceiling roses shall be to BS 67:1987 and shall be complete with adequate number and capacity of terminals.

Plug-in ceiling roses shall be to BS 7001:1988

### **2.4.4 13A Socket Outlets**

13A socket outlets shall be to BS 1363-5:2016

Switched socket outlets shall have double pole switches.

Where indicated, socket outlets shall be complete with neon indicators.

### **2.4.5 13A Fused Connection Units**

13A fused connection units shall be to BS 5733:2010+A1:2014 complete with a BS 1363-5:2016 fuse of suitable rating for the equipment serviced.

Switched fused connection units shall have double pole switches.

Where indicated, fused connection units shall be provided with neon indicators and/or flex outlets.

### **2.4.6 Double Pole Switches**

Double pole switches shall be to BS EN 60669-1:2018, 13/30256232 DC and BS 4177:1992 and shall be either 20A, 32A or 45A rated as appropriate.

Double pole switches shall be provided with neon indicators and where required flex outlets.

### **2.4.7 Cooker Control Units**

Cooker control units shall be to BS 4177:1992 and shall be complete with neon indicators.



#### **2.4.8 13A Plug Tops**

13A plug tops shall be to BS 1363-1: 2016+A1:2017 complete with cord grip and shrouded phase and neutral pins.

#### **2.4.9 Dimmers**

Wall mounted dimmers for tungsten filament lamps shall be to BS EN 60669-2-1:2004+A12:2010 with radio interference suppression to BS EN 55014-1:2017.

Wall mounted dimmers for LED lamps shall be to BS EN 60669-2-1:2004+A12:2010 with radio interference suppression to BS EN 55014-1:2017.

#### **2.4.10 Telephone Outlet Plates**

Telephone outlet plates shall be to BS 6312-1:1994.

#### **2.4.11 Industrial Plugs and Socket Outlets**

Industrial socket outlets shall be to BS EN 60309-2:1999+A2:2012, IEC 60309-2:1999 and BS EN 60309-1:1999+A2:2012, IEC 60309-1:1999 and shall be suitably rated for the voltage and current duty.

Sockets shall be provided complete with plugs and both shall be of the appropriate IP rating to BS EN 60529:1992+A2:2013.

#### **2.4.12 Mounting Boxes**

All accessories shall be mounted on boxes to BS 4662:2006+A1:2009.

Flush accessories shall be mounted on steel zinc electro-plated boxes with adjustable fixing lugs.

Surface mounted accessories shall be mounted on matching boxes provided by the accessory manufacturer.

All boxes shall be complete with a brass earth terminal.

A 2.5 sq.mm. green/yellow earth lead shall be provided between the accessory and the box.

### **2.5 Fire Alarm Systems**

#### **2.5.1 General**

All fire alarm systems and equipment shall be installed in accordance with BS 5839-1:2017 or BS 5839-6:2013.

#### **2.5.2 Control Panels**

Control and indicating panels shall be manufactured to BS EN 54-2:1997+A1:2006

#### **2.5.3 Manual Call Points (MCPs)**

Manual call points shall comply with BS EN 54-11:2001 and shall be flush mounted on steel boxes. Where metallic sheathed cables are looped at MCPs earth continuity of the cable shall be maintained by installation of purpose made earth continuity links. MCPs shall generally be mounted at 1.4m above floor level.



#### **2.5.4 Smoke Detectors (SDs)**

##### Single Point Ionisation (SDI)

Ionisation type smoke detectors shall comply with BS EN 54-7:2018. They shall be surface mounted on a plug-in type mounting base. Cables shall be terminated in a mild steel BESA conduit box.

Attention is drawn to clause 25.4 and Appendix E of BS 5839 : Part 1 with respect to the installer's responsibility for compliance with any Statutory requirements for the storage, transport, use and disposal of radioactive materials and the manufacturer's advice should be sought in this respect.

##### Single Point Optical (SDO)

Optical type smoke detectors shall comply with BS EN 54-7:2018. They shall be surface mounted on a plug-in type mounting base. Cables shall be terminated in a mild steel BESA conduit box.

#### **2.5.5 Optical Beam (SDB)**

Optical beam smoke detectors shall comply with BS EN 54-12:2015

#### **2.5.6 Domestic Smoke Detectors (SDD)**

Single point domestic smoke detectors and alarms shall be to BS EN 14604:2005, BS 5446-2:2003 and BS EN 14604:2005 and shall be suitable for 220 volt A.C. operation.

#### **2.5.7 Heat Detectors (HD's)**

##### Rate of Rise (HDR)

Rate of rise type heat detectors shall comply with BS EN 54-5:2017+A1:2018

##### Fixed Temperature (HDF)

Fixed temperature type heat detectors shall comply with BS EN 54-5:2017+A1:2018, with an operating temperature of 60°C.

All heat detectors shall be mounted on a plug-in mounting base which shall be interchangeable with the smoke detector base. Cables shall terminate into a mild steel BESA conduit box.

#### **2.5.8 Remote Indicators**

Where required, automatic detectors shall be fitted with remote indicator lights. The indicator shall comprise a LED mounted on a single gang plate suitable for mounting on a standard one gang accessory box. Each indicator plate shall be engraved to indicate the location of the detector, i.e. "LIFT SHAFT", etc.

#### **2.5.9 Sounders**

Sounders shall generally be mounted at 2.5 metres above floor level.

Sounders for external use shall be of the weather resistant type.

#### **2.5.10 Visual Alarms**

Within areas where a high ambient noise level may be expected i.e. plantroom, a xenon flasher type visual alarm unit shall be installed on a mild steel BESA conduit box.





### **2.5.11 Inspection, Testing and Commissioning**

The whole of the installation shall be inspected, tested and commissioned in accordance with clause 26 of BS 5839-1 and as further described.

The fire alarm equipment manufacturer shall be employed to commission the system.

Commissioning shall be carried out in accordance with clause 26.5 of BS 5839-1, which shall include:-

An audibility test of the alarm devices. Audibility level readings shall be taken in each room using an instrument complying with BS EN 61672-2:2003, BS EN 61672-1:2003, type 2 with slow response and a weighting. Any sound pressure levels found to be lower than that required by clause 9.4.1 of BS 5839-1 shall be reported in writing to the Engineer.

All trigger devices, i.e. manual call points, heat detectors and smoke detectors, shall be tested for correct operation.

A mains failure test shall be carried out to verify the standby battery system complies with the requirements of this specification.

A certificate of installation and commissioning of the system, (see Appendix B and C of BS 5839-1) shall be provided to the Engineer. It should be noted that a Practical Completion Certificate will not be issued until this installation and commissioning certificate has been received, and the installation and commissioning certificate will not be accepted unless it is accompanied with the Record Drawings and User Manuals and the system Log Book (see Appendix D of BS 5839-1).

## **2.6 Earthing and Bonding**

### **2.6.1 General**

A full system of earthing and bonding shall be provided fully in accordance with the IEE Regulations, BS 7430:2011+A1:2015, and the Regional Electricity companies Regulations.

### **2.6.2 Conductors**

All conductors shall be copper either BS 6004:2012, PVC insulated or BS EN 13601:2013 PVC covered copper strip, of the size and type as detailed on the drawings.

Conductors shall have green/yellow insulation throughout their entire length.

### **2.6.3 Main Earth Bar**

A main earth bar shall be provided adjacent the main L.V. switch panel.

The bar shall be a minimum of 300mm long, and formed from 50mm x 6mm hard drawn copper to BS 7430:2011+A1:2015.

The main earth bar shall be wall mounted on insulators and shall be complete with disconnector link between the main earth conductor and the bonding and conductors as required by IET Regulations 542-4-2.

### **2.6.4 Clamps and Connections**

All clamps and connections shall be made using proprietary accessories.

All conductors shall be terminated using crimp type cable sockets.



### 2.6.5 Warning Notices

At the point of connection of every bonding conductor or to every earth electrode, a permanent label durably marked "Safety Electrical Connection - Do Not Remove", shall be fixed near to and visible from the connection to BS 951:2009.

### 2.6.6 Earth Electrodes

Earth electrodes shall comprise steel core copper clad rods.

## 2.7 Identification

### 2.7.1 General

All electrical services shall be identified as required by Regulation 514 of BS 7671:18th Edition (IET Wiring Regulations).

### 2.7.2 Labelling

Labels shall be manufactured from engraved thermosetting plastic laminate designed to BS EN ISO 7010:2012+A7:2017.

Labels shall be fixed using a minimum of two round headed screws either screwed into tapped holes or bolted through complete with washer nut and locking device.

Adhesive or self-tapping screws shall not be used.

Labels shall generally be black letters on a white background for information labels and white letters on a red background for warning labels.

Labels shall be provided for but not limited to:-

#### Switchgear

All items of switchgear shall be labelled to indicate the function, protective device type and rating, outgoing and incoming cable sizes and types and details of equipment served.

Each outgoing way on main switch panels shall be provided with individual labels.

#### Distribution Boards

Distribution boards shall be labelled to indicate their function and reference.

#### Earthing System

The main earthing bars shall be labelled "Main Earth Bar". Each individual earthing or bonding conductor shall be labelled to indicate its function and size.

#### Isolator Switches

All isolator switches shall be labelled to indicate the function, equipment served and any circuit reference.

#### Ancillary Equipment

All ancillary equipment, e.g. junction boxes, contactors, control equipment, etc. shall be labelled to indicate their function.



### **2.7.3 Engraving**

All accessories, for which the function is not inherently apparent, shall be engraved to indicate their function.

Engraving shall generally be 6mm high letters, coloured red.

### **2.7.4 Notices**

All Statutory and other Regulatory notices shall be fitted, including:-

- Warning notices
- Period inspection and test notices
- Electric shock notices
- Safety signs
- Emergency procedures
- Operational and maintenance notices.

## **2.8 Inspection, Testing and Commissioning**

### **2.8.1 General**

The whole of the works shall be inspected and tested in accordance with Part 6 of BS 7671:18th Edition (IET Wiring Regulations).

Test methods and procedures shall be in accordance with Guidance Notes to the 18th Edition of the IET Wiring Regulations as issued by the IET.

The safety procedures detailed in Guidance Note GS 38 'Electrical test equipment for use by Electricians' issued by the Health and Safety Executive should be observed.

The person or persons responsible for inspecting and testing the installation shall be fully trained and competent to carry out such duties.

All test equipment and instruments shall be provided correctly calibrated and certified for the limits of accuracy necessary which should be a minimum equivalent to Class 2 to BS EN 60051-1:2017 and BS EN 61557-(1 through to 16).

### **2.8.2 High Voltage Cables**

HV cables shall be pressure tested prior to commissioning using a dc voltage as recommended in the relevant British Standard for the cable types being tested. The test voltage shall be applied and increased gradually to the full value and maintained at the full value for a minimum of 15 minutes.

### **2.8.3 Inspection and Test Records**

All inspection and test results shall be documented and included in the Operating and Maintenance Manuals.

Inspection records shall take the form of check lists based upon Appendix 6 of the IET Wiring Regulations Guidance Note Number 3.

Test results shall be recorded on the Test Record Sheet included in this specification.

Upon completion, a Completion and Inspection Certificate similar to the model in Appendix 6 of BS 7671:18th Edition (IET Wiring Regulations) shall be completed, signed and included in the Operating and Maintenance Manual.



#### **2.8.4 Commissioning**

All systems shall be fully commissioned; where necessary commissioning companies shall be employed to carry out the function.

The commissioning shall comprise; the setting of the systems into their operational state and adjusting to obtain the required performance.

### **2.9 Operating and Maintenance Manuals**

#### **2.9.1 Description and Scope of Works**

The works under this section of the specification includes the supply to the Employer Operating and Maintenance Manuals for the installation.

The manuals will be required to be handed over on or before practical completion of the works.

Draft copies of the manual shall be submitted to the Engineer for comment at least four weeks prior to practical completion.

The works shall not be deemed to be complete until satisfactory manuals including all appropriate test and commissioning data and certificates have been provided.

#### **2.9.2 Contents of Operating and Maintenance Manual**

The format of the Manual shall be in accordance with the following sections after a preface and index.

- Section 1 Shall comprise:- Introduction, abbreviations, Health and Safety at Work Act and warning notices etc.
- Section 2 Shall comprise:- A full non-technical description of each system together with the main plant components and locations.
- Section 3 Shall comprise:- The complete plant technical data of each item of equipment, e.g. manufacturers' names and addresses, type and size of unit, serial number, order number, unit performance and protective device performance and duty details etc. This information shall be derived from a site inspection of identification plates together with information obtained from manufacturers.
- Section 4 Shall describe:- in detail the operating procedures necessary for setting to work and powering down each individual system. This shall include the main switchgear, sub-distribution equipment, final circuits, specialist control panels starter and selection facilities, together with any alarm and safety interlocks all of which shall be derived from a site inspection.
- Section 5 Shall comprise:- The maintenance operations on a daily, weekly, monthly etc. basis for each item of plant. The preparation of this section shall be carried out by obtaining from the manufacturer his advice and recommendations for adjustment, tests and routine maintenance.
- Section 6 Shall comprise:- The emergency procedures to be adopted by personnel engaged on the operation and maintenance of the mechanical and electrical services, with respect to fire, first aid, general failures to the electrical systems, and call out procedures for maintenance personnel in working hours.



- Section 7 Shall comprise:- A recommended action on plant malfunction to assist both the user maintenance engineer in the event of a fault developing in a system by indicating the nature of the fault and recommended action.
- Section 8 Shall comprise:- A list of recommended spares and lubricants. The preparation of this section shall be carried out by obtaining the manufacturer's recommendations and also incorporating the Employer's requirements regarding spares.
- Section 9 Shall comprise:- A schedule of the record drawings together with reduced copies (A4 size) of the record drawings in numerical order. The reduced copies of the record drawings shall be printed on good quality paper identical to the paper used for the remainder of the Manual.
- Section 10 Shall comprise:- Test certificates and commissioning reports. Test certificates for equipment and installed works shall be supplied to the "Specialist Manual Supplier" by the Sub-Contractor.
- Section 11 Shall comprise:- A list of manufacturers including addresses and telephone numbers of equipment supplied. The list shall be alphabetical order. The manufacturers' literature shall also be included and arranged in alphabetical order to match the manufacturers' list.

### **2.9.3 Preparation of the Manual**

The Manuals shall be prepared within the contract and shall be particular to the electrical services of the contract.

The Manual shall be arranged with an index and referencing system.

The paper to be used in the final issue of the Manual shall be good quality high white 100g/m<sup>2</sup> and the reproduction method shall be dry photocopy. The material of the manufacturers' literature shall be as supplied by the manufacturers and the number of sets shall be in accordance with the number of Manuals required.

The covers shall be hard bound with four post loose leaf system. The contract details shall be embossed on the front cover. A matching flysheet shall give the names and addresses of the principals involved on the contract and agreed with the Engineer.

Numbered card dividers shall be inserted between sections.

The complete sets of Manuals shall be provided to the Engineer at Practical Completion.

## **2.10 Record Drawings**

### **2.10.1 Description and Scope of Works**

The works under this section of the specification shall include the preparation and supply to the Engineer of two full sets of bound Record Drawings and one set of master negatives, and one set of discs suitable for reading with an AutoCAD software programme. The latest issue of the programme shall be used unless otherwise agreed before the contract is let.



### 2.10.2 Contents of the Drawings

The drawings shall indicate the following:-

- 1st Drawing: Main schematics and detail wiring diagrams shall indicate length, size and type of cables, earth loop impedances at all part of the system, fault levels at the main switchpanel and each distribution board.
- 2nd set of Drawings: Floor layouts (scale 1:50 or 1:100) indicating clearly location of all electrical plant and equipment (including luminaires and their reference), wiring routes, protective bonding points, etc.
- 3rd set of Drawings: Detail layouts (scale 1:20) of switchroom, electrical riser and plant rooms indicating clearly the location of all electrical plant and equipment, wiring routes, protective bonding joints, etc.

### 2.10.3 Preparation of the Drawings

The drawings shall be particular to the electrical services of the contract.

A draft set of the drawings shall be issued for approval if practically possible prior to Practical Completion or within 2 weeks of this date.

The paper to be used in the final issue shall be good quality high white 100g/m<sup>2</sup> whilst the master negatives shall be good quality.

Each drawing shall be folded and inserted into a plastic wallet which shall be bound into a separate Manual compatible to the Operating and Maintenance Manual. The cover shall be hard bound with a four post loose leaf system. The contract details shall be embossed on the front cover. A preface and index shall be provided giving details of the drawings

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Helping You Drive Your Carbon Footprint Down